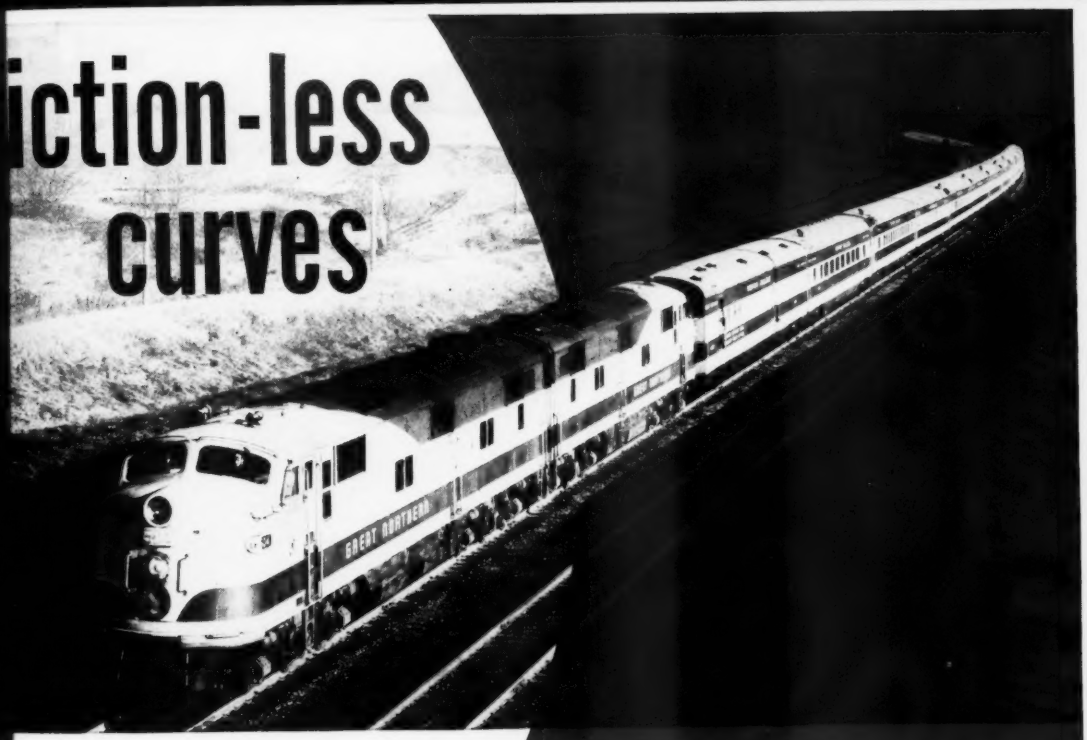
Railway Engineering and Maintenance

iction-less curves



meco
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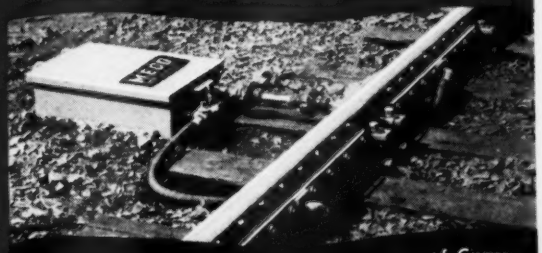
peeds, heavier rolling equipment and
ause increased strain and wear on
ails—unless the friction area be-
heels and rails is lubricated by

CO LUBRICATORS

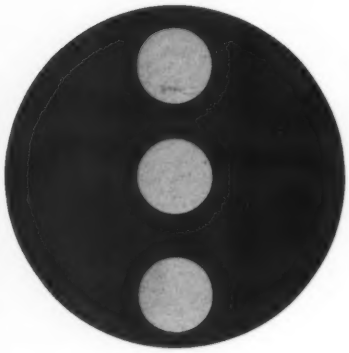
ed wheel-against-rail friction
rail life two to four times,
wheel life, reduces main-
labor, and increases the
f train operation.

IMPROVED MECO LUBRICATOR
TYPE MBJ

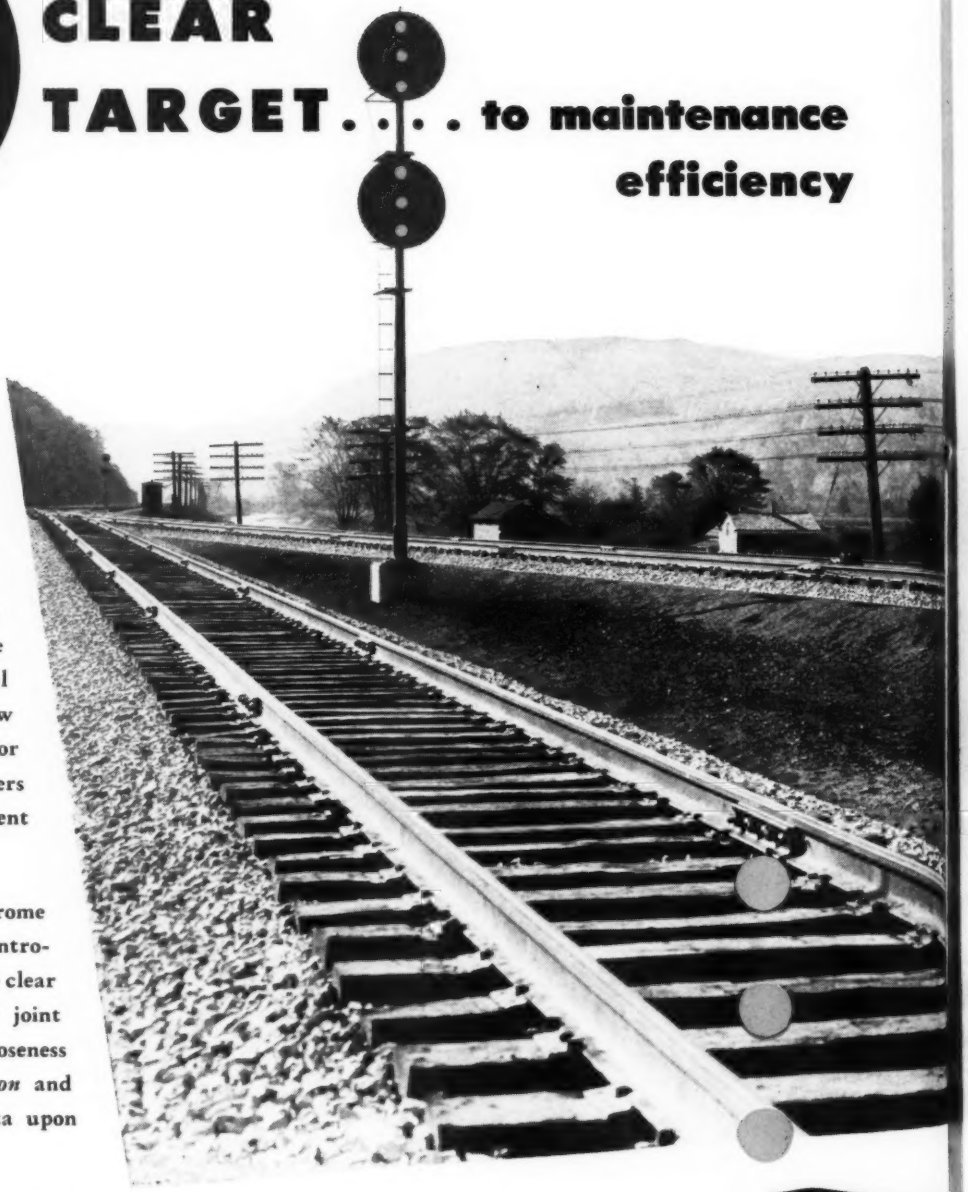


Each Meco Lubricator Protects a Number of Curves

★ Maintenance Equipment Company ★
RAILWAY EXCHANGE BUILDING • CHICAGO 4, ILLINOIS



CLEAR TARGET . . . . to maintenance efficiency



Tight joint bolts are a must, and ways of reducing maintenance cost without jeopardizing this condition are well worth your careful consideration. The new A.R.E.A. specification for joint bolt spring washers increases the requirement for *greater tension.*

The new Xtra-hy Hy-Crome Spring Washers just introduced by Reliance are the clear target ahead to greater joint bolt protection from looseness thru their greater *tension* and *travel.* Samples and data upon request.

Reliance Hy-Pressure Hy-Crome Spring Washers used for years by leading railroads are also well worthy of your attention.

Reliance **Xtra-hy hy-crome** *spring washers*

EATON
EATON MANUFACTURING COMPANY

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Offices & Plant - MASSILLON, OHIO

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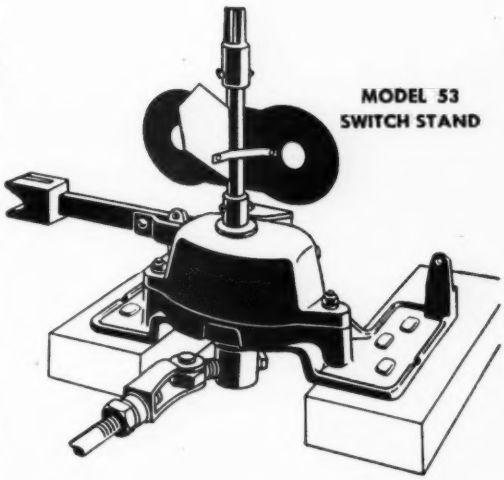
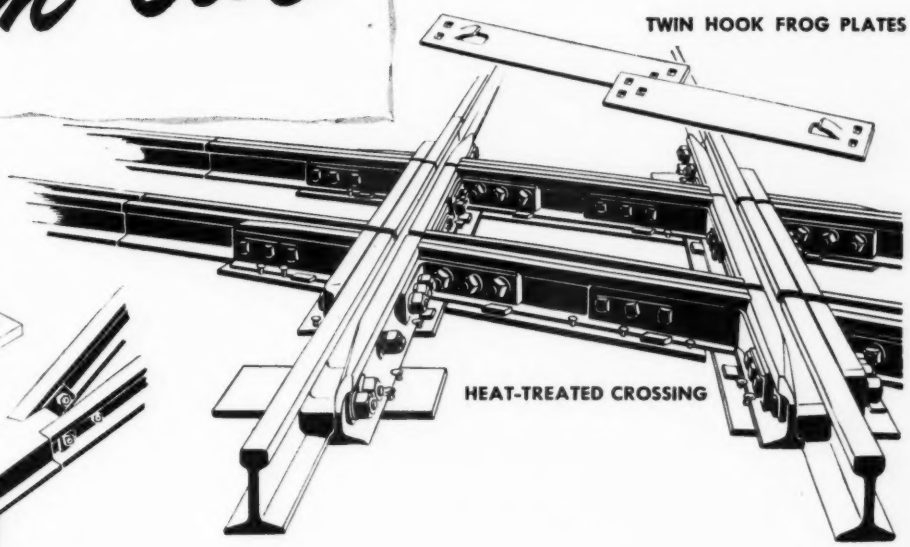
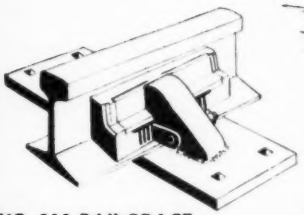
You Can Bank On Them All



MODEL 53
SWITCH STAND

TWIN HOOK FROG PLATES

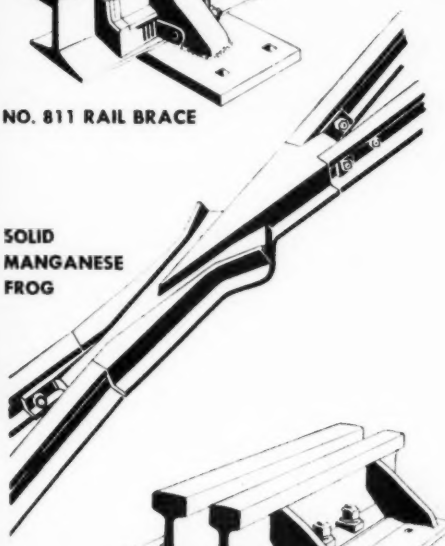


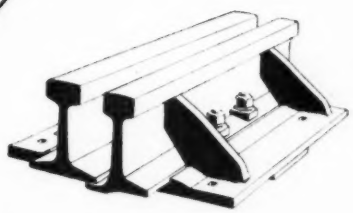


NO. 811 RAIL BRACE

HEAT-TREATED CROSSING

SOLID
MANGANESE
FROG





IMPROVED HOOK-FLANGE
GUARD RAIL

Every Bethlehem track product can be relied upon to do a competent job. This dependability, amply proved over a long span of years, is the strongest selling-point we could possibly advance.

Bethlehem manufactures virtually every item of track and track accessories. Big special layouts? We can build them for you. Switch stands, braces, frog plates, guard rails? They're Bethlehem specialties. Spikes, bolts, nuts? Yes, these too — and many other items vital to the modern track system. You can bank on them all.

Whether you need a keg of bolts or a complete track layout for yard, dock, or terminal, let Bethlehem take care of it. Your confidence will not be misplaced.

BETHLEHEM STEEL

★ BETHLEHEM STEEL ★

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

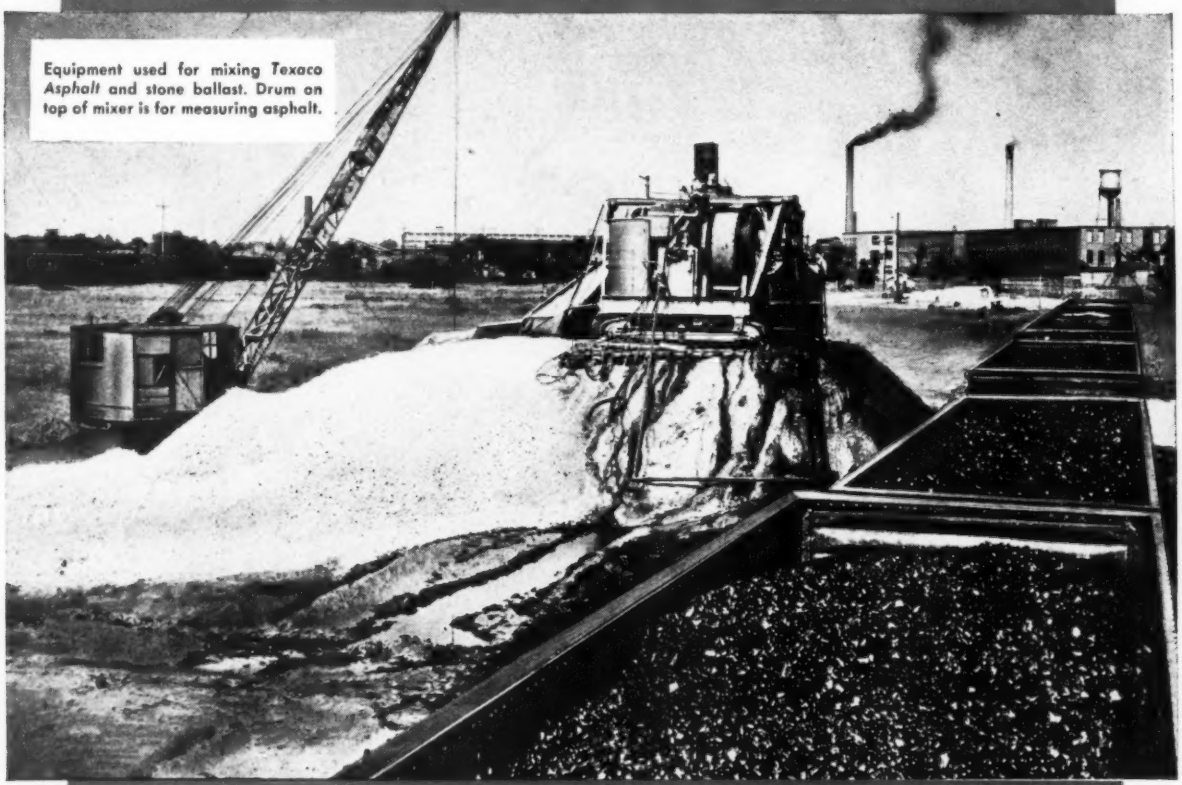
On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation
Export Distributor: Bethlehem Steel Export Corporation

Some of the many Bethlehem Track Products:

BOLTS AND NUTS . . SPIKES . . CROSSINGS . . FROG PLATES
FROGS . . GAGE RODS . . GUARD RAILS . . JOINT BARS . . RAIL BRACES
RAILS . . SWITCHES . . SWITCH HEATERS . . SWITCH STANDS . . TIE PLATES

Published monthly by Simmons-Boardman Publishing Corporation, 105 W. Adams St., Chicago 3, Ill. Subscription price: United States and Possessions, and Canada, $2.00 for one year; $3.00 for two years. Single copies 50 cents. Entered as second-class matter January 20, 1933, at the post office at Chicago, Ill., under the act of March 3, 1879, with additional entry at Mount Morris, Ill., post office. Address communications to 105 W. Adams St., Chicago 3, Ill.

LOWER ROADBED MAINTENANCE COSTS START HERE



Equipment used for mixing *Texaco Asphalt* and stone ballast. Drum on top of mixer is for measuring asphalt.

Put a coating of Texaco Asphalt on stone ballast and gain 4 big savings.

WHEN stone ballast is coated with *Texaco Asphalt*, these benefits result:

1. Drainage problems vanish—asphalt-coated ballast sheds water quickly.
2. Fouling from dirt and cinders is prevented.
3. Ballast stays flexible—does not crack under traffic and can be tamped even after long service.
4. Track stays in line and on grade for years with minimum attention.

With these benefits, it's easy to see how maintenance costs go down! Remember, too, that *Texaco Asphalt* is long lasting, low in cost and easy to apply. Leading railroads use it particularly for ballasting station and other hard-to-drain track.

Just be sure you use *Texaco Asphalt*—America's *quality* asphalt proved through forty years of service on streets, highways and railroads.

For complete information on maintenance savings possible with *Texaco Asphalt*, call the nearest Railway Sales Division office listed below, or write The Texas Company, *Railway Sales Division*, 135 East 42nd Street, New York 17, New York.

NEW YORK • CHICAGO • SAN FRANCISCO • ST. PAUL • ST. LOUIS • ATLANTA

TEXACO

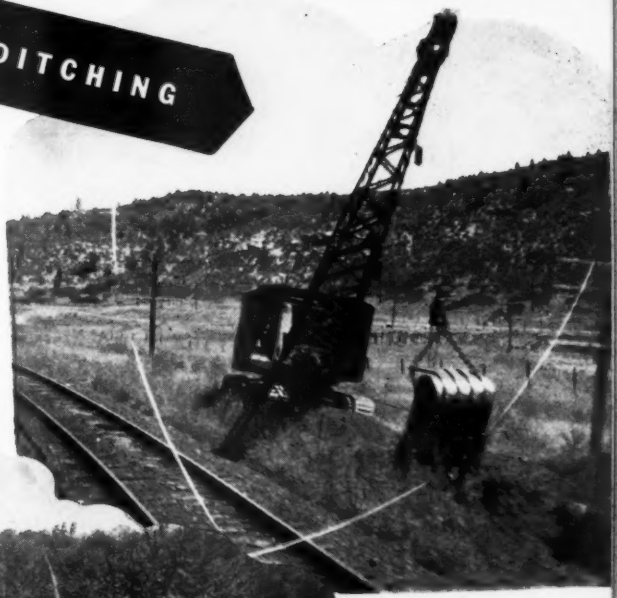
TEXACO Asphalt for Coating Ballast

Tune in...Texaco Star Theatre every Wednesday night featuring Gordon MacRae and Evelyn Knight...ABC Network

NORTHWEST

for the heart of those maintenance-of-way jobs!

DITCHING



BUILDING SHOULDERS

TRIMMING BANK

Your Shovels, Cranes and Draglines in the heart of your maintenance jobs must often work well out on the line. The more you can cut down the service to maintenance equipment the lower you cut maintenance-of-way costs. Your Northwest Crawler Cranes, Draglines and Shovels load and unload themselves under their own power. On ditching jobs, old or new shoulder work, or bank trimming, they operate off-the-line. Rail equipment is seldom required. The line is clear but the work goes on. On-the-line work can be handled just as with track type equipment, with your Northwest loaded on the car, and with the additional advantage that a Northwest will travel from flatcar to flatcar or through open-end gondolas, unloading as it goes.

Simplicity of design simplifies maintenance in out-of-the-way locations. The "Feather-Touch" Clutch Control assures easy operation and is free from tubing, valves and pumps. With the "Feather-Touch" Clutch Control there will be no shutdowns because of control failure. The Cushion Clutch relieves all parts under power when the shock over loads come on. Uniform Pressure Swing Clutches take the jerks and grabs out of swinging, improving control for "spotting", increasing output and safety.

You are buying Crane and Shovel equipment for the "*Key Spots*". You can't afford to have anything but the best for the heart of your jobs. Northwests do things no track type machine can do. Let us give you more details.

NORTHWEST ENGINEERING COMPANY • 1513 Field Bldg., 135 South LaSalle St. • Chicago 3, Ill

MAKE YOUR KEY MACHINE A NORTHWEST CRAWLER for the heart of the job

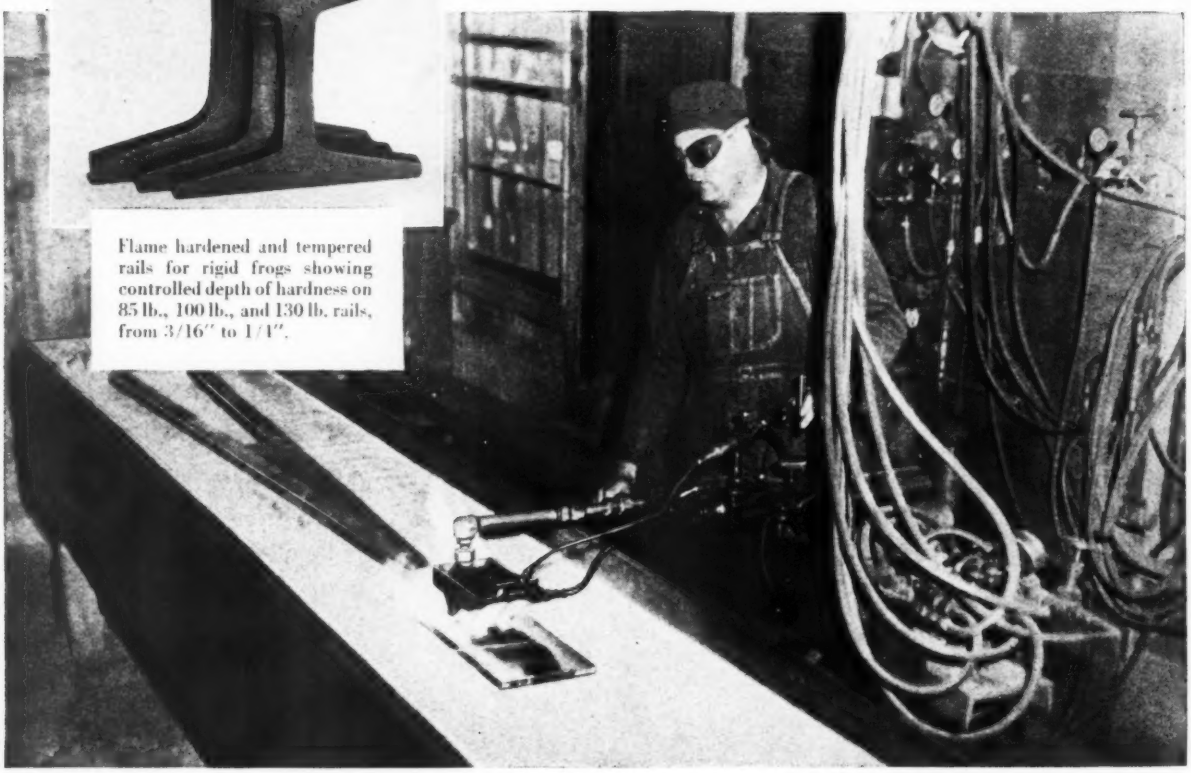
NORTHWEST

THE ALL PURPOSE RAILROAD MACHINE
SHOVEL • CRANE • DRAGLINE • PULLSHOVEL

Here's How "Costs Come Down Under the Airco Plan"

"We have used Airco flame hardened frogs since 1944, and have saved $1253.11 on a single installation"

. . . says a leading railroad in the Southwest.



Flame hardened and tempered rails for rigid frogs showing controlled depth of hardness on 85 lb., 100 lb., and 130 lb. rails, from 3/16" to 1/4".

Several years ago frog service life on this railroad averaged six months—replacement costs were $209.39 for each new installation.

In March 1944 Airco's modern flame hardening method was introduced, and flame hardened frogs were installed under regular traffic conditions.

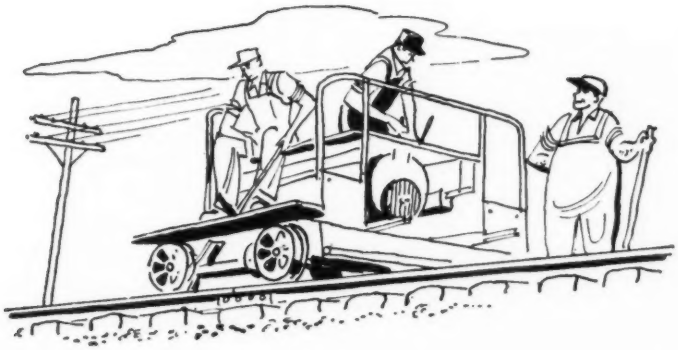
A continuing test on one of these flame hardened frogs was made. Three years later it was still in service, giving it a life of seven ordinary replacements—resulting in an actual saving of $1253.11.

The Airco flame hardening method is simple and economical. It is flexible and selective for application in the shop or field on small or large objects—flat or circular surfaces. Its outstanding quality is it provides sufficient surface hardness to retard wear without affecting toughness or shock resistance of the core metal.

For further details about this process write for free, illustrated information. Or if you prefer, an Airco railroad technical representative will be glad to call on you personally. Just write your nearest Airco office or Dept. 7752, Air Reduction, General Offices, 60 East 42nd Street, New York 17, N. Y. In Texas: Magnolia Airco Gas Products Company, General Offices, Houston 1, Texas.

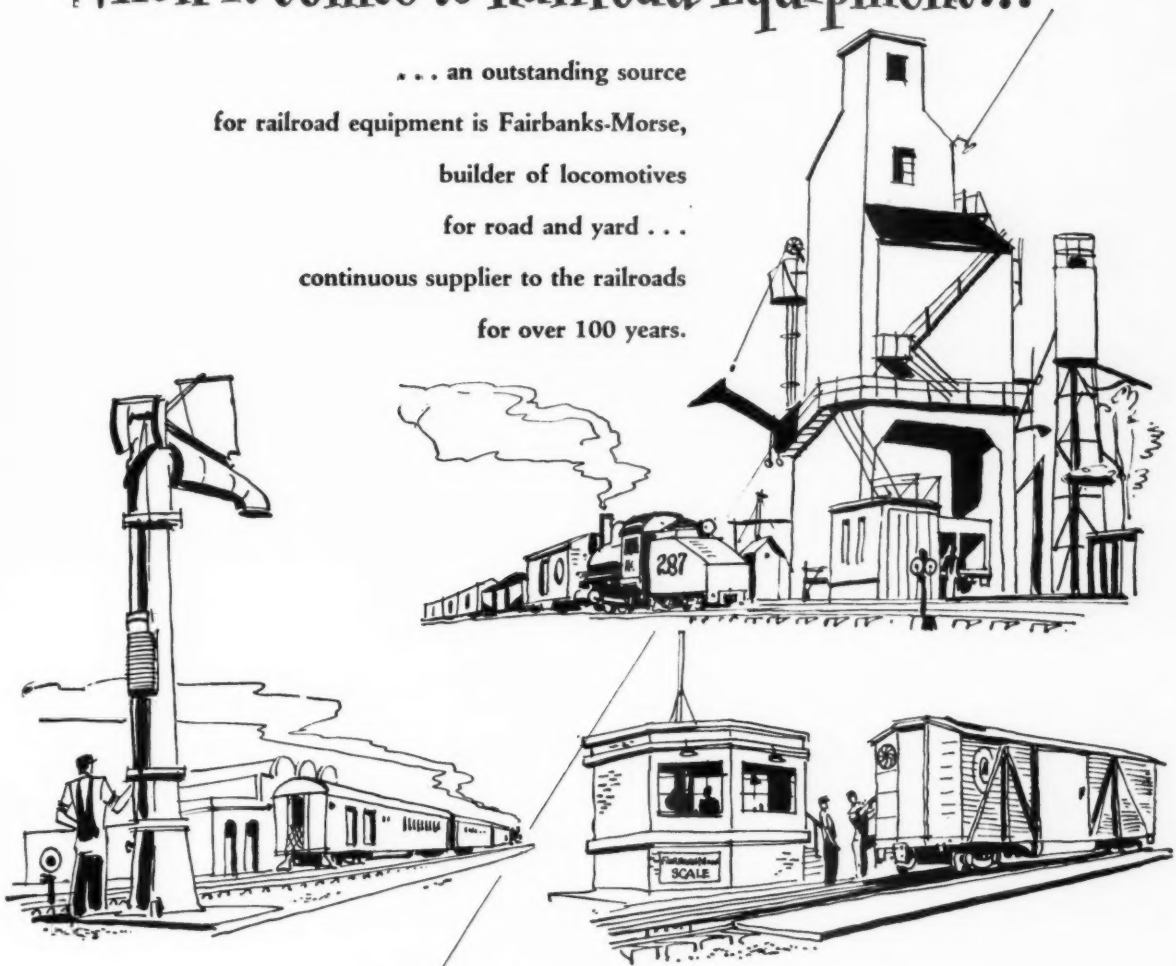
AIRCO **AIR REDUCTION**
Offices in All Principal Cities

Costs Come Down Under the Airco Plan



When it comes to Railroad Equipment...

. . . an outstanding source
for railroad equipment is Fairbanks-Morse,
builder of locomotives
for road and yard . . .
continuous supplier to the railroads
for over 100 years.



DIESEL LOCOMOTIVES • DIESEL ENGINES
STOKERS • SCALES • MOTORS • GENERATORS
PUMPS • RAILROAD MOTOR CARS and STAND-
PIPES • FARM EQUIPMENT • MAGNETOS

FAIRBANKS-MORSE

A name worth remembering

Champions

in EVERY TYPE of BALLAST and ANY LIFT-OF-TRACK—

Surfacing, Spotting, Skeletonizing

3 Quickly interchangeable Blades

Assure Peak Performance universally

BLADE No. MT97-A1

(left and right)

The "SPEED" blade for moderate to high lift surfacing and for the lower lifts where finer ballasts are used. The tip of this blade is 9 inches wide.

BLADE No. U625-1A

(left and right)

Most universally used for all operations in gravel, slag or 1½" to 2" stone, including "Spotting." Point acts as a pick for opening hole beneath tie.

BLADE No. U-609

For removing badly cemented ballast in tie renewal or skeletonizing operations, removing ice around the track or grading work in frozen ground this blade really does a job.

What a full set of specially designed tools is to the skilled mechanic, the three quickly interchangeable blades are to Jackson Vibratory Tampers. They permit doing each job with the greatest possible dispatch and in the most efficient manner. For the "all-over" job of track maintenance, including surfacing, spotting, skeletonizing, ice removal—all major ballast placing operations — Jackson Tampers and Power Plants lead all other equipment by a wide margin. This irrefutable fact can easily be proven on your own track. If interested, drop us a line.

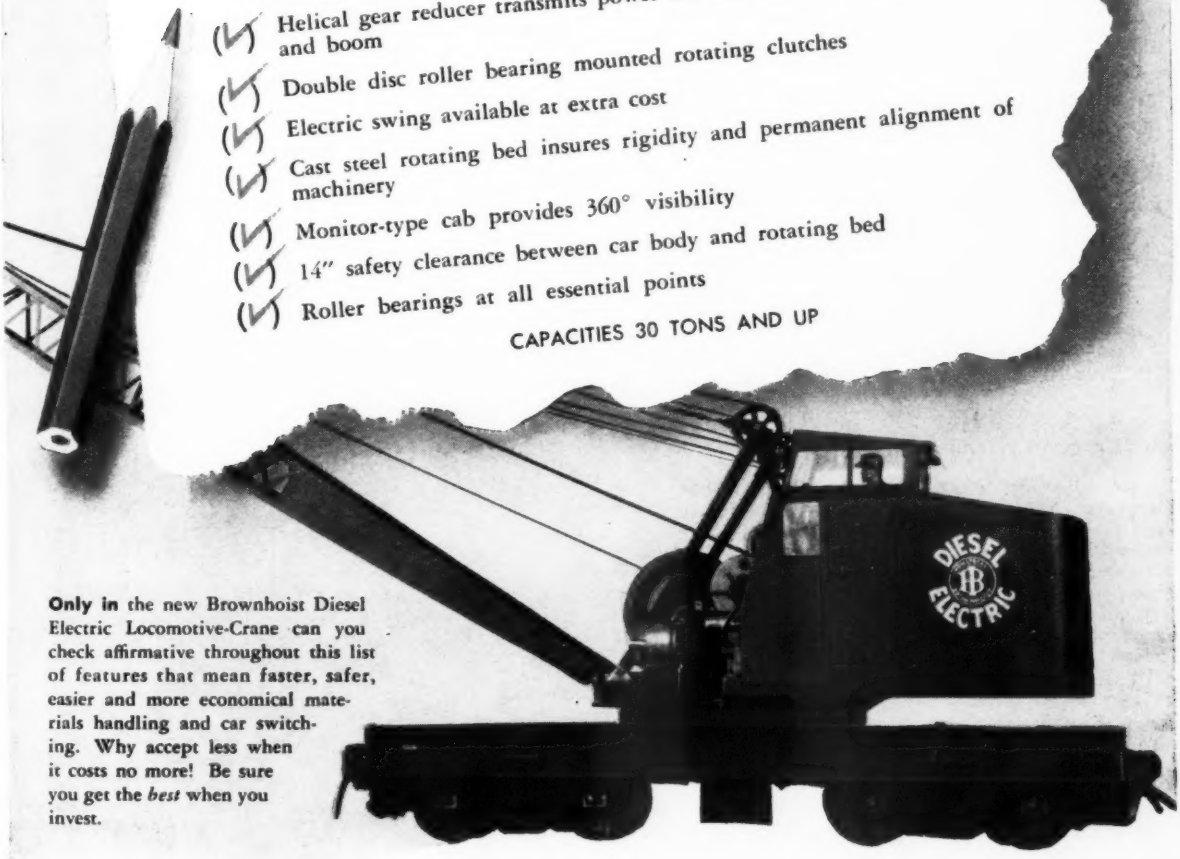
JACKSON vibratory tie tampers

ELECTRIC TAMPER & EQUIPMENT CO. LUDINGTON MICHIGAN

Check this list of Brownhoist features... when you're thinking of a diesel electric locomotive-crane

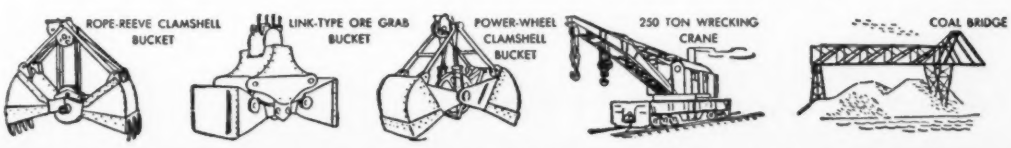
- (✓) Travel power applied direct to axles by 2 oversize inside hung spring-mounted motors
- (✓) Motor current supplied from generator direct connected to Diesel engine
- (✓) Travel speeds up to 15 MPH. for heavy duty switching service
- (✓) Helical gear reducer transmits power for hoist drums, swing, and boom
- (✓) Double disc roller bearing mounted rotating clutches
- (✓) Electric swing available at extra cost
- (✓) Cast steel rotating bed insures rigidity and permanent alignment of machinery
- (✓) Monitor-type cab provides 360° visibility
- (✓) 14" safety clearance between car body and rotating bed
- (✓) Roller bearings at all essential points

CAPACITIES 30 TONS AND UP



Only in the new Brownhoist Diesel Electric Locomotive-Crane can you check affirmative throughout this list of features that mean faster, safer, easier and more economical materials handling and car switching. Why accept less when it costs no more! Be sure you get the *best* when you invest.

BROWNHOIST BUILDS BETTER CRANES



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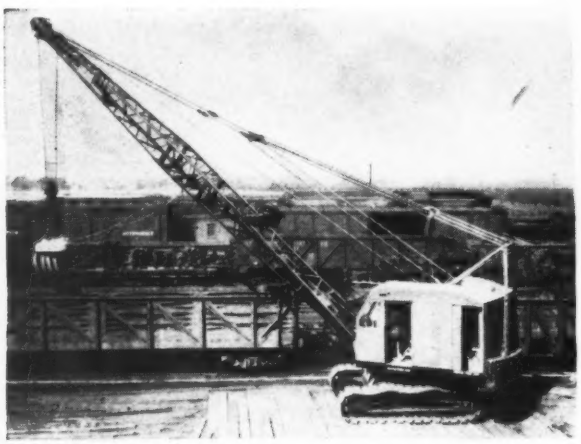
LINK-BELT SPEEDER

MOBILE HANDLING EQUIPMENT "INDISPENSABLE" IN MODERN STORES AND REPAIR SHOPS

The numerous materials handling jobs connected with yard work, such as unloading and stock-piling of stores, coal, ballast, etc., as well as much of the lifting required by car repairs are performed most efficiently by Link-Belt Speeder mobile cranes. Free of the track and self propelled they go anywhere at any time, neither interfering with traffic nor being hampered by rolling stock occupying the rails.



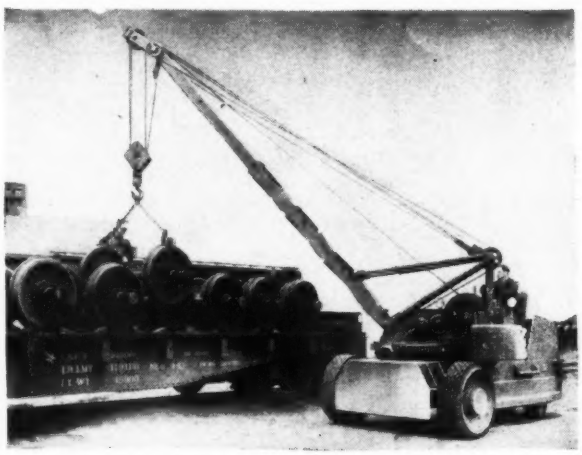
The Illinois Central's storekeeper at giant Markham Yard praises the LS-90 for the way it speeds up the loading of prefabricated parts onto cars for movement into the shops and for handling wheels and other heavy materials.

The smooth action and easy control of these machines make it possible for a crew of one or two men to accomplish a large variety of handling operations. From handling rails, frogs and switches with a sling, to loading coal or other loose material with clamshell, is a quick, easy change. Tie plates, spikes or other parts in bulk, as well as scrap, are handled in a clean and efficient manner with a magnet. Even spotting cars is a simple operation for a nimble, powerful Link-Belt Speeder.

Fast handling of scrap or small parts such as tie-plates is routine work for the LS-90 magnet crane. Its action is smooth and steady, without jiggle or jar, eliminating spillage.

Spotting cars is an easy operation with the powerful LS-90.

The Link-Belt Speeder Cargocrane wheel-mounted speeds up and simplifies many lifting and carrying operations in yards and shops. It will travel anywhere, is easily maneuvered in narrow spaces and turns on an extra small radius. The boom swings in a full circle, and all controls including steering are by easy hydraulic action, with power supplied by a positive displacement pump powered by the engine. It has a telescopic boom with maximum reach of 20' and lifts loads up to 10 tons.



The YC-9 Cargocrane puts a 10 ton lifting capacity at the finger tips of its operator. It is especially useful in car repair work, being easily maneuvered into the best operating position.

A LINK-BELT SPEEDER distributor near you, will gladly give you full particulars on the Link-Belt Speeder line, of 25 models, including a type and size to meet every requirement.

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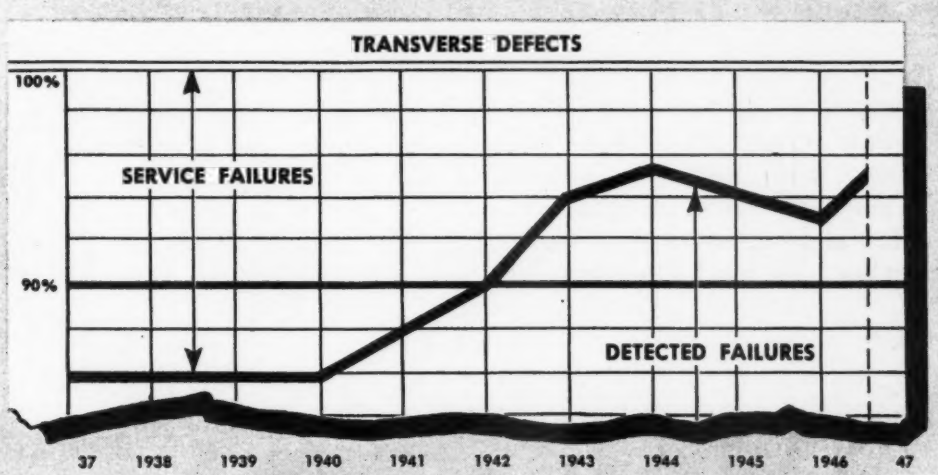
LINK-BELT SPEEDER

LINK-BELT SPEEDER CORPORATION, CEDAR RAPIDS, IOWA

Builders of the Most Complete Line of SHOVELS-CRANES-DRAGLINES

Detected Rail Failures / Total Failures (DETECTED & SERVICE) = Rail Testing Efficiency



Railroads Using SPERRY RAIL SERVICE Attain 95% Efficiency in Rail Testing

The chart above shows the average efficiency in rail testing attained by railroads who report all service failures to Sperry and who *use Sperry Rail Service exclusively*. For some of these, efficiencies are *well above* the average which has been graphed; for all, the *trend has been upward* over the years.

Improved rail testing efficiencies are principally the result of constantly improved service by Sperry-operated Detector Cars. Better performance has been accomplished by continuous research in rail defects and rail testing, enabling Sperry to find:

1. MORE AND SMALLER TRANSVERSE DEFECTS than any other method of rail testing.

2. MORE LONGITUDINAL DEFECTS than any other method of rail testing.

More than 100 Railroads recognize that only with Sperry Rail Service are highest efficiencies in rail testing available—resulting in maximum protection against derailments, and therefore:

1. ***Increased Public Safety***
2. ***Decreased Costs***

Today as always, Sperry stands ready to make comparative demonstration tests to prove this superior detection performance.

SP-128

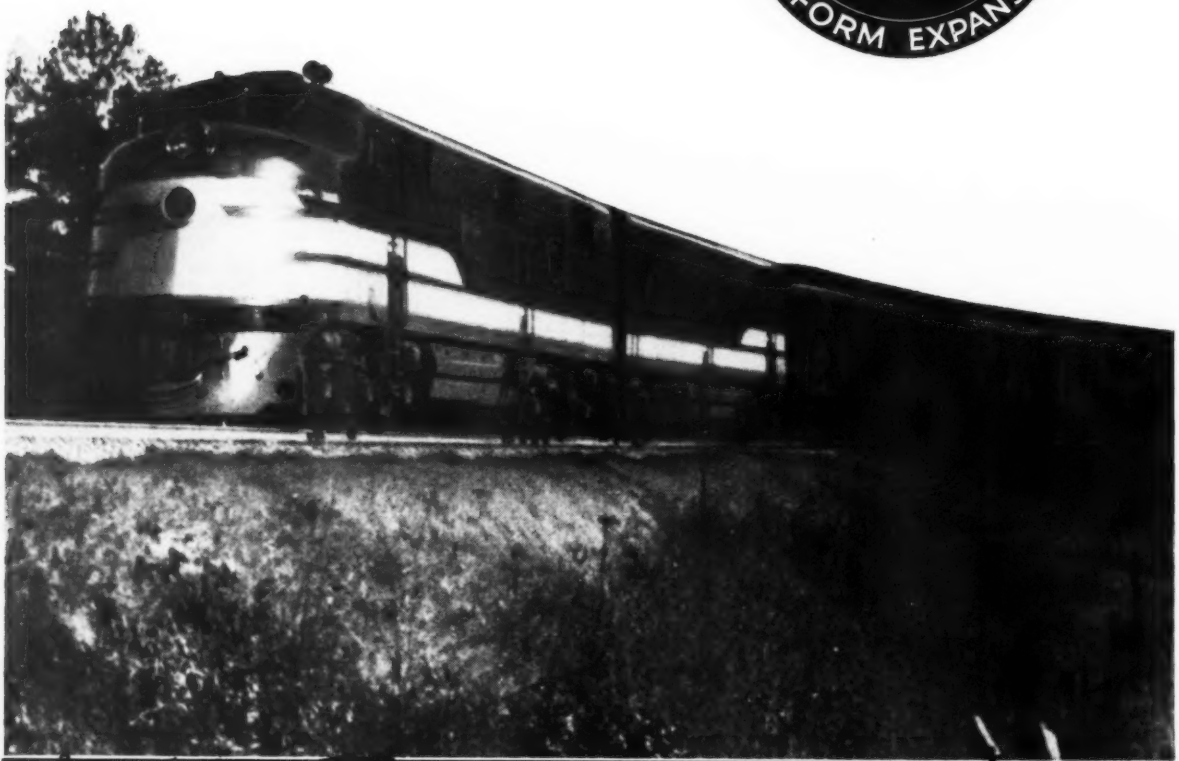
SPERRY RAIL SERVICE

DIVISION OF SPERRY PRODUCTS, INC.
CHICAGO, ILL. HOBOKEN, N. J. ST. LOUIS, MO.

COMPRESSION

Rail Anchors

Economical, *two-way* protection against creepage. Insures all-around lower track maintenance on main line traffic, bridges, turn-outs and crossings—wherever running rail must be stopped.



THE RAILS COMPANY

General Office

178 GOFFE STREET, NEW HAVEN 11, CONN.

ST. LOUIS, MO. HOBOKEN, N. J. CHICAGO, ILL.

Isn't it about time

central heating *to get on with it*

as a common sense means of Fuel Conservation?

The ability of the United States to assure its security and maintain its position of leadership in the world depends ultimately upon its fuel reserves. Misuse of these vital resources can mean decline and disaster.

Nearly 99% of this country's known fuel reserves is in the form of coal. The United States has all the coal it needs for many generations to come. The reserves of other fuels, however, are being exhaused at an alarmingly increasing rate, largely because they are being used to do certain jobs which coal can do as well or better.

One of the major causes of this unsound state of affairs is the public demand for convenient, "push-button" heat that is clean, efficient and labor-free. To meet this demand, non-solid fuels are being extravagantly misused in ordinary heating in spite of the fact that they are urgently needed for other essential purposes. Coal, properly used, can provide everything the public demands in the way of "push-button" heat.

Central Heating is the solution—using steam or hot water distribution from centrally located heat generating plants serving entire communities.

For the vast majority of people in this country space heating is by far the most costly of utility services, indeed more costly than all other essential utilities combined. Certainly, an economic system which has been able to provide our communities with water, sewers, gas, electricity and telephone service—certainly, that same economic system is no less able to provide this even more basic service of Central Heating at a cost attractive to consumers and at a profit equally attractive to investors.

With a realistic appraisal of our fuel resources in the light of conditions which exist in the world today, and with the end in view of a better and stronger United States of America, secure in a way of life made possible by private enterprise fostered and bulwarked by governmental institutions—*isn't it time to get on with it now?*

the RIC-WIL company

UNION COMMERCE BUILDING

CLEVELAND, OHIO

Medium Size Motor Grader

BRINGS YOU . . .

HEAVY-DUTY PERFORMANCE WITH NEW ECONOMY

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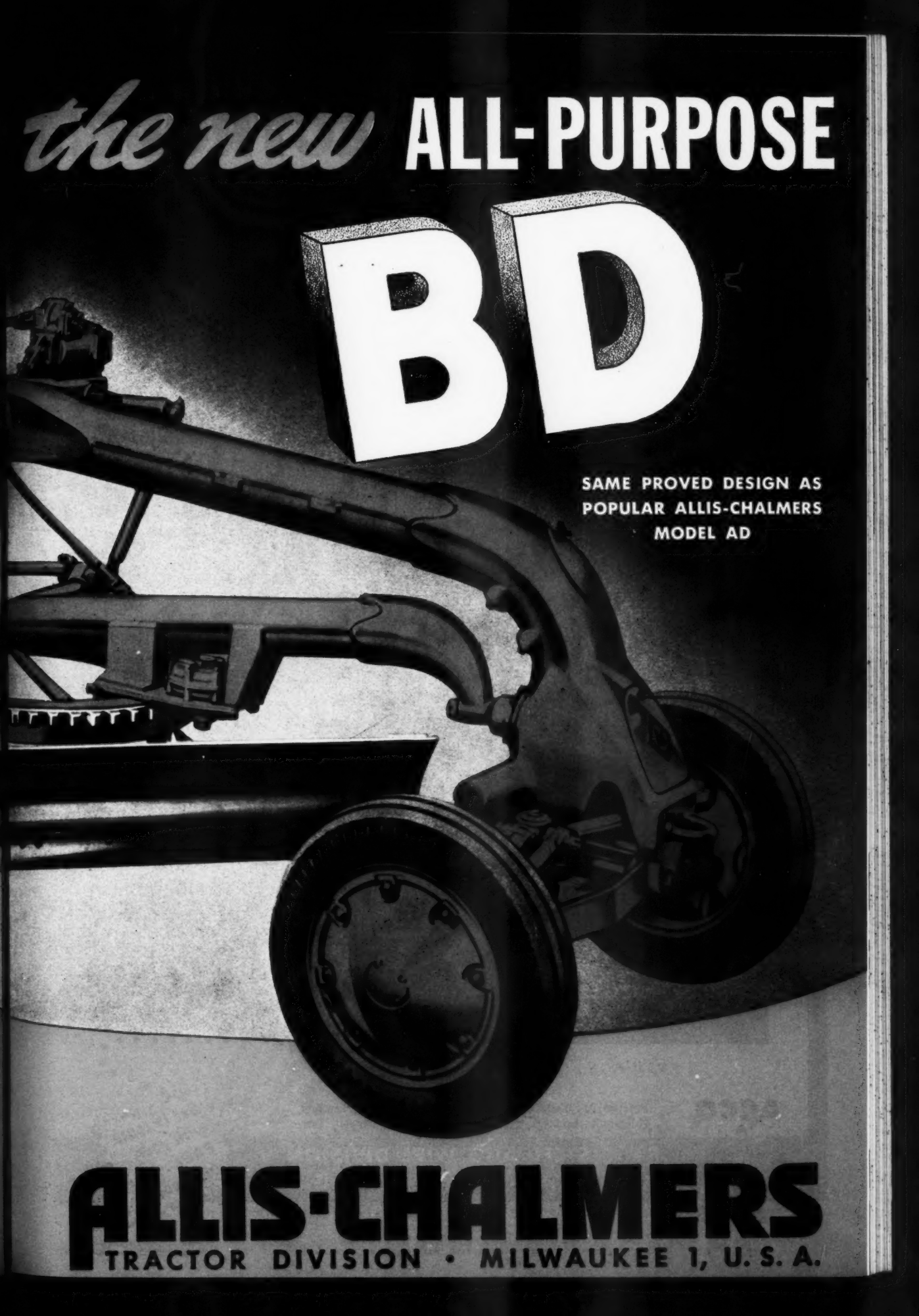
- ✔ WEIGHT: 17,300 lbs.— balanced for maximum traction and control.
- ✔ SPEEDS: Six forward—1.30 to 14.69 m.p.h. Three reverse—1.55 to 5.41 m.p.h.
- ✔ Exclusive Tubular Frame.
- ✔ 28-inch working throat clearance — 22-inch axle clearance.
- ✔ 12-foot "Roll-Away" Moldboard — 360° turning radius.
- ✔ Full Blade Visibility; Simplified Maintenance; Comfortable Platform; Rigid Steering Control.

LOW OPERATING COST • SUPERIOR PERFORMANCE • DEPENDABLE SERVICE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We found out a long time ago that welding stainless steel is not always as simple as it looks. So we set out to study the problems and find the answers.

Since then we have developed the complete line of PAGE-Allegheny Stainless Steel Electrodes and Gas Welding Rods. More important, we have collected—from our Field Service men, our distributors and their customers—a valuable fund of information about welding techniques. We have been able to offer real help to many fabricators of stainless steel.

If you are welding Stainless, we suggest that you . . . . . .

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PAGE STEEL AND WIRE DIVISION
AMERICAN CHAIN & CABLE

For additional information, use postcard, pages 635-636

Packs the EXTRA WALLOP

that Drives Cut-Spikes FASTER!

A TOOL OF MANY USES

A quick, simple change in the front head will adapt your Thor No. 25 Spike Driver for breaking concrete and ice, cutting asphalt, digging clay and shale, and many other jobs.

Thor

PNEUMATIC

SPIKE DRIVER

Maintenance Gang foremen know that they lay more track when their crews are equipped with powerful, easy-handling Thor Pneumatic Spike Drivers. They've seen the results that Thor's extra-long, shorter-travel piston brings through harder blows. A block type, with a "business end" at both ends, the Thor piston is reversible for double life . . . and lower maintenance cost. It is in perfect balance with the cylinder and the Thor automatic valve to provide smooth operation that assures easy handling. Also, because of the shorter travel of both piston and valve, the Thor Spike Driver gets *more work* from all the air—a vital factor where portable compressors are used.

Both light and heavy duty models are available in the Thor line. See your nearby Thor contractors' tool dealer for full details and a free demonstration.

INDEPENDENT PNEUMATIC TOOL COMPANY
Aurora, Illinois
Export Division: 330 West 42nd Street, New York 18, N. Y.

Birmingham · Boston · Buffalo · Chicago · Cincinnati · Cleveland · Denver
Detroit · Houston · Los Angeles · Milwaukee · New York · Philadelphia
Pittsburgh · St. Louis · St. Paul · Salt Lake City · Seattle
San Francisco · Toronto, Canada · Sao Paulo, Brazil · London, England

Thor **PORTABLE POWER TOOLS**

PNEUMATIC TOOLS • UNIVERSAL AND HIGH FREQUENCY ELECTRIC TOOLS • MINING AND CONTRACTORS TOOLS

TOURNADOZERS

THIS POWERFUL rubber-tired rig rolls easily over any surface . . . pavement, macadam, blacktop, cross country or along the right-of-way . . . anywhere in or out of your yard. Tournadozer can cross rails or ride along tracks without damage to ties or tires . . . drive swiftly to any job in your section without tying up work-train equipment or delaying rail traffic.

½ Mile is only 2 minutes away

The Tournadozer's ability to make self-powered moves at 15 m.p.h. saves you time and money. You can drive a mile in 4 minutes . . . a half-mile in 2 minutes! You get to trouble faster . . . complete the job more quickly . . . return in less time.

Dozes 30 percent faster

Tournadozer is faster on the job, too. With four speeds forward and reverse up to 15 m.p.h., you can doze a full load 30% faster . . . back up for next pass three times faster . . . complete your dozing cycle in ⅓ the time it takes a slow-moving crawler. With constant-mesh, constant-power transmission and instantaneous speed selection, Tournadozer can travel 200 feet in the 10 seconds a track-type dozer wastes shifting gears.

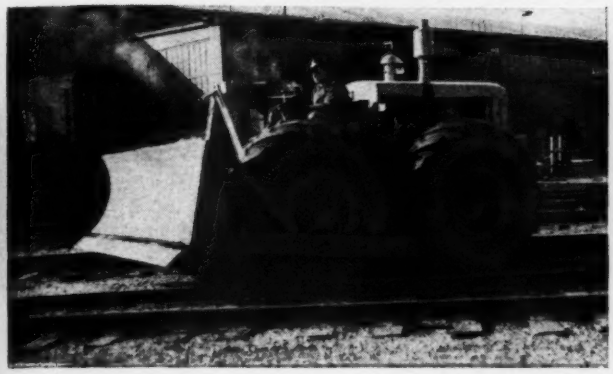
Extra maneuverability and power

In addition, its 180 h.p. Diesel and 21.00 x 25 ground-gripping tires give you all the traction, dozing and pushing power you need for your all-around dozer work . . . plus twice the speed and maneuverability of a cumbersome, limited-travel crawler.

LETOURNEAU LET EQUIPMENT

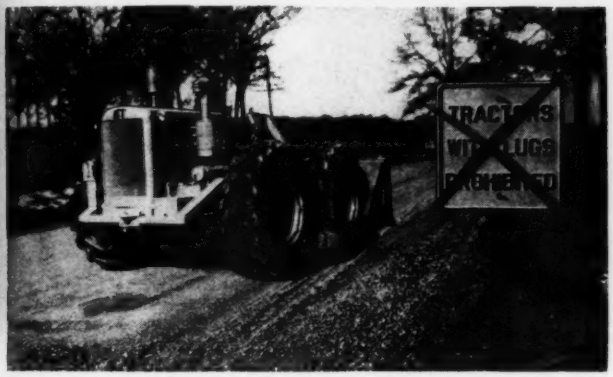
It's RUBBER THAT PUTS THE ACTION IN TRACTION . . . See your LeTourneau Distributor NOW for complete information

can go anywhere!

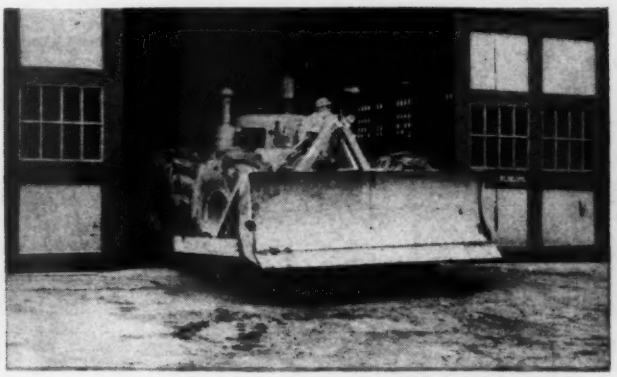


Across rails — Tournadozer is ideal for use along railroad right-of-way . . . it can cross and recross tracks at will . . . swiftly . . . without damage to rails, ties or tires.

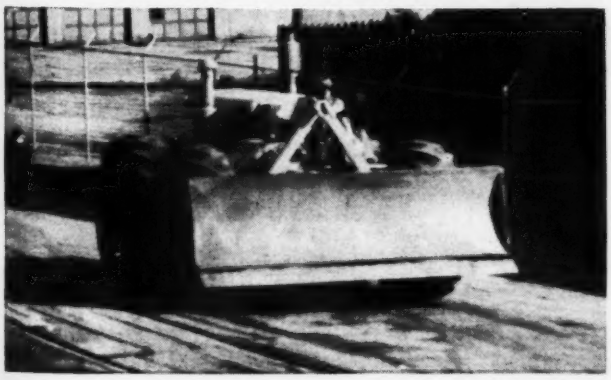
City Streets — Tournadozer rolls smoothly along highways or streets . . . accurate controls give easy steering . . . multiple-disc air brakes give quick, safe stops.



Over highways — Tournadozer has no cleats to chew up gravel surface asphalt or macadam . . . rubber tires are safe on asphalt or any road surface, hot or cold.



Inside plants — Tournadozer's pushing power and maneuverability can be used profitably in buildings or on any floor surface designed to sustain heavy equipment.



In storage areas — Tournadozer works safely on any type yard-area surfacing. Power, mobility and speed, cut costs on stockpile and industrial plant applications.

CLIP AND MAIL TODAY

R. G. LeTOURNEAU, Inc., Peoria, Ill.

Please send facts on 180 h.p. C Tournadozer

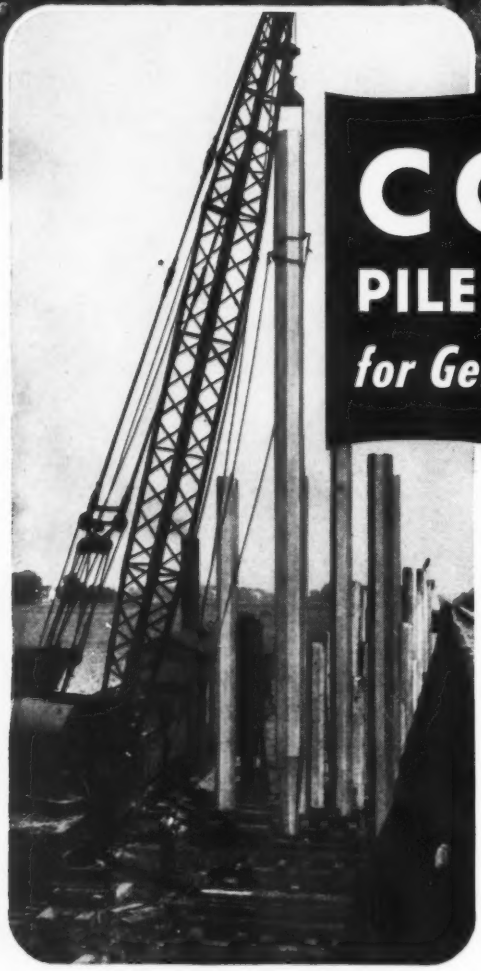
NAME..... TITLE.....

COMPANY.....

ADDRESS.....

Tournadozer—Trademark C86-RR

LETOURNEAU PEORIA, ILLINOIS — HIGH-SPEED RUBBER-TIRED **TOURNADOZERS**



CONCRETE
PILE and SLAB TRESTLES
for Generations of Low Cost Service

When the Louisville & Nashville Railroad decided to replace the old timber trestle at Henderson, Ky., they made a survey to find the most economical type of bridge to build and maintain. Then they chose a reinforced concrete precast pile and slab trestle with a three-pile bent type of construction.

This type, they found, offered the greatest ultimate load-carrying capacity, greater flood resistance, maximum firesafety, lower upkeep and simplicity of construction.

Large precast reinforced concrete piles are preferred for trestles by many American railroads because they (1) give low cost per ton of load capacity, (2) are firesafe, (3) have long life, (4) can be designed to meet a wide variety of climatic, topographic and service conditions, (5) defy termites and other borers.

For help in solving your bridge problems write for a free copy of 80-page booklet, "*Concrete Piles.*" It tells about their design, manufacture and driving. Distributed only in the United States and Canada.

Upper photo: L & N's famous streamliner, the Georgian, crossing the new concrete pile and slab trestle.

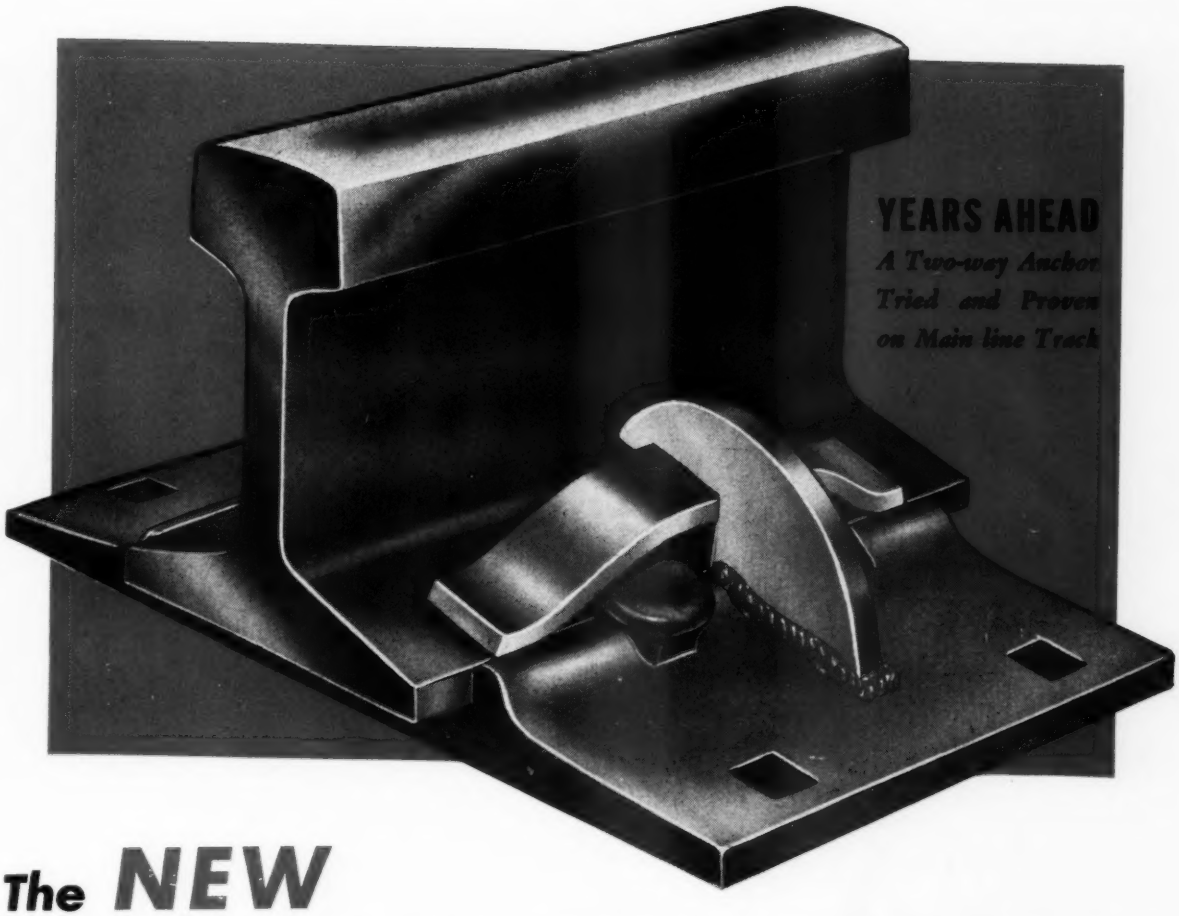
Lower photo: Setting one of the 24 in. diameter precast reinforced concrete piles.

The 11,626-ft.-long trestle contains 629 spans. Each bent consists of three piles; every sixth one is an anchor bent with a double row of piles. Concrete piles are 24 in. octagonal design, mostly 50 ft. long.

PORTLAND CEMENT ASSOCIATION

DEPT. 6-27 • 33 W. GRAND AVENUE • CHICAGO 10, ILLINOIS

A national organization to improve and extend the uses of portland cement and concrete . . . through scientific research and engineering field work



The NEW NO-CREEP RAIL ANCHOR

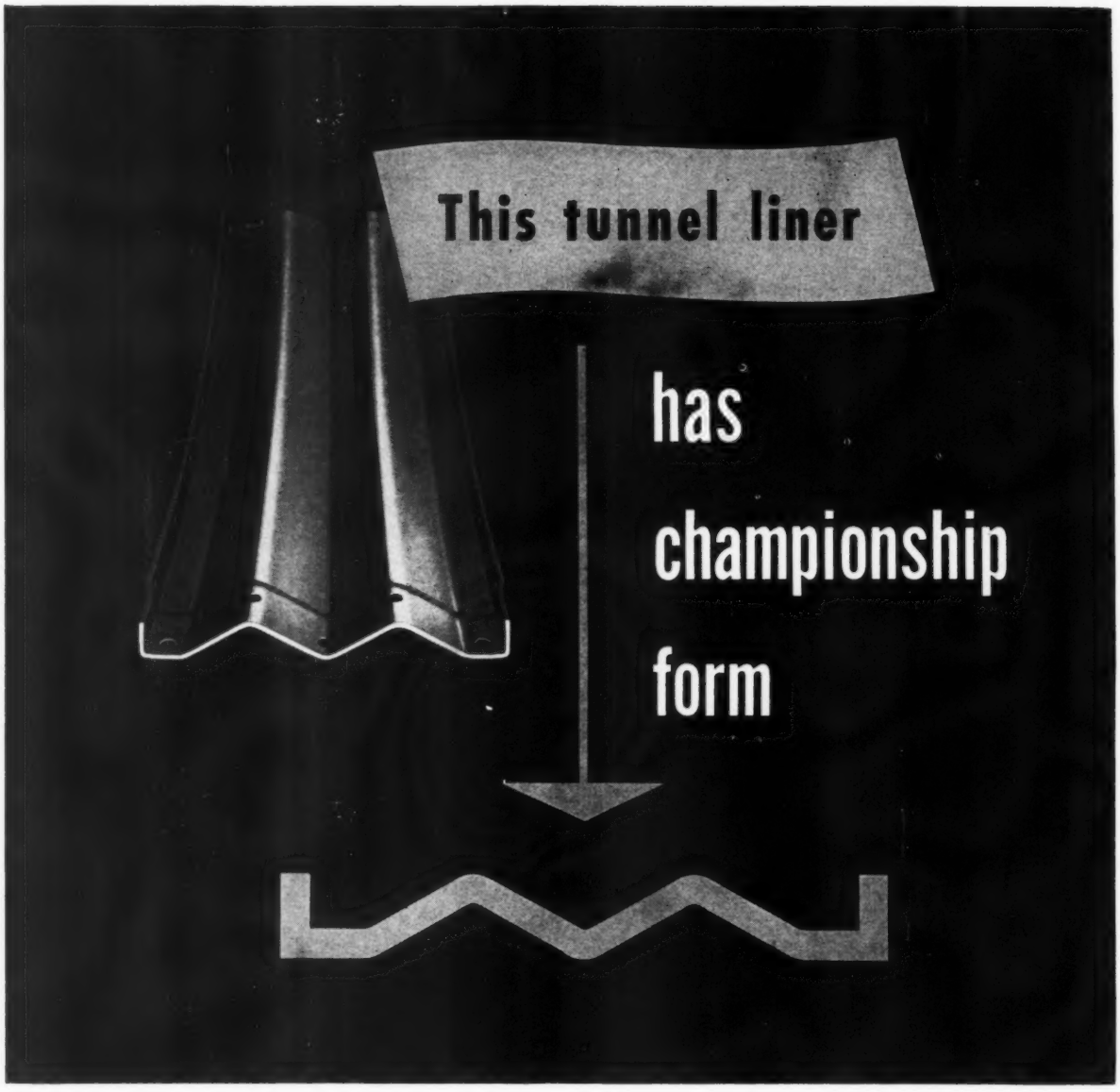
Designed for Problems of Today and the Track of Tomorrow

1. Maintenance practically eliminated.
2. Engineering allowance made to provide greater strength than needed.
3. No adjustments—
   Cannot get out of adjustment.
4. Low first installation cost.
5. Does not nick rail in event of derailments.
6. Rail Spike is retained in wood—cannot work up.
7. Cannot be abused during installation.
8. A simple tool quickly removes or installs the spring.
9. Each installation delivers adequate compression between the tie plate and rail base.
10. UNIVERSAL: This two-way anchor is applicable to any weight of rail or design of tie plate and is JUST AS EFFECTIVE ON RELAID WORN RAILS AS ON NEW RAILS.

Write for Particulars

G & H RAIL CONTROLS, INC.

Phone BE 8117 **5204 E. 15th St.,** **Kansas City 1, Mo.**



Take a good look at the corrugated metal shape of ARMCO Liner Plate. It's the design that gives you safe strength without excessive weight. On a pound for pound basis these plates are in a class by themselves. They save money and speed the job on lining new tunnels or relining old ones.

Less bulk means that one unskilled workman can carry, hold, and bolt into place an ARMCO Liner Section. Only a hand wrench is needed. Labor costs are low and the job goes fast.

With ARMCO Liner Plates you gain added safety, fire protection and utmost economy. No paying "hidden costs" in excess weight. And ARMCO Plates are nestable to conserve hauling and storage space. Inside diameters range from 45-1/4 inches to 397-1/4 inches (33 feet) and in gages from No. 14 to No. 3.

You'll find ARMCO Liner Plates the simple inexpensive way to construct underground passageways without disturbing the surface. The chances are you'll "hole through" ahead of schedule and under the estimate. Use these plates for conduits, tunnels, underpasses and wherever else you need the protection and other advantages of a steel liner. Write for prices and complete information. Armco Drainage & Metal Products, Inc., 3505 Curtis St., Middletown, O.

EXPORT: THE ARMCO INTERNATIONAL CORPORATION

ARMCO

ARMCO LINER PLATES

Ingersoll-Rand

SPOT-AIR

New

SECTION-GANG COMPRESSOR

LIGHT enough to carry!

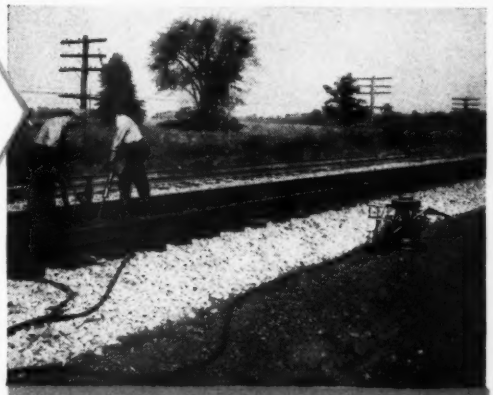
The Ingersoll-Rand SPOT-AIR is the lightest and most compact section-gang compressor yet developed. This gasoline-powered unit can be carried easily by two men. And one man can transport both the SPOT-AIR and Air Tools with the specially designed wheelbarrow type mounting which is available. This means less wasted effort... more work done.

The SPOT-AIR needs very little room in storage or on a section car, and is ideal for center-ditch operation under traffic. It is completely air cooled and is unique in its arrangement of engine and compressor cylinders about a single crank.

BIG enough for the job!

The SPOT-AIR has ample capacity to run two I-R tie-tampers... and you'll find it ideal for operating paving breakers, drills, impact wrenches, and many other I-R Air Tools.

Put the Ingersoll-Rand SPOT-AIR on your track work, bridge and building, grade-crossing and signal maintenance or emergency jobs. You will get better, faster work at lower cost.



IR

AIR TOOLS • COMPRESSORS • ROCK DRILLS • CENTRIFUGAL PUMPS • TURBO BLOWERS OIL AND GAS ENGINES • CONDENSERS

Ingersoll-Rand

11 BROADWAY, NEW YORK 4, N. Y. 221-11

THE American DIESELECTRIC

A Revolutionary New Locomotive Crane

Once upon a time, the coal scoop was a mighty important tool on locomotive cranes. But new and better power sent the scoop to the scrap heap.

Today, with the AMERICAN DIESELECTRIC on the scene, many other outworn features are disappearing forever. For example, the cluttered, awkward machinery deck—where even the simple job of greasing can be unbelievably expensive—has now been magically transformed.

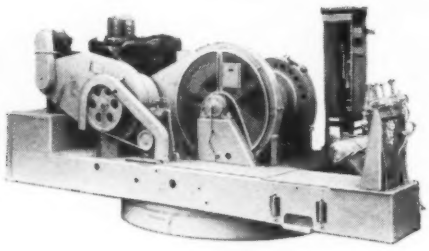
Summed up, the many advanced new features of the DIESELECTRIC mean just this: Tremendously increased production . . . astonishing cash savings on maintenance work . . . faster operating speeds . . . less operator fatigue . . . *more tons moved at lower cost.*

- **DIESEL** *power to the deck;* **ELECTRIC** *power to the trucks*
- **SEVEN TONS** *of wearing parts eliminated*
- **CUTS UPKEEP** *25% to 50%*
- **PAYS FOR ITSELF** *in five years!*

American Hoist
and DERRICK COMPANY
St. Paul 1, Minnesota

Plant No. 2: So. KEARNY, N.J. • *Sales Offices:* NEW YORK CHICAGO • PITTSBURGH • NEW ORLEANS • SAN FRANCISCO

NEW Deck Design
MAKES SERVICE WORK EASY!



● It's what you <u>don't</u> see in this picture of the DIESELECTRIC machinery deck that's important. First, all travel machinery is gone—because the electric traction system is all in the underbody. There's no pyramiding of machinery. Tail swing has been shortened by two feet. Walkways are clear, open, safe. All units needing repair or lubrication are instantly accessible. Result: lowest maintenance costs in locomotive crane history!

AMERICAN HOIST
and DERRICK COMPANY 8605
St. Paul 1, Minnesota

Please send your Catalog No. 600-L-4, describing the AMERICAN DIESELECTRIC Locomotive Crane.

Name_____

Company_____

Address_____

City_____ State_____

Hammers Down Costs on Jobs Like These

- Chipping, cleaning and removing weld spatter after arc-welding
- Removing scale, rust, old paint from boilers, tanks, stacks and structural steel
- Chiseling "Vee" in cracked casting for stronger weld
- Drilling in concrete to make bolt holes for heavy machinery installation
- Gouging timbers—seaming and caulking

B & D HAMMER cleaning up arc-welding job with cold chisel.

THERE are plenty of places where you can use Black & Decker Electric Hammers in maintenance work . . . to save long hours of hand labor that pile up your costs and slow down your jobs!

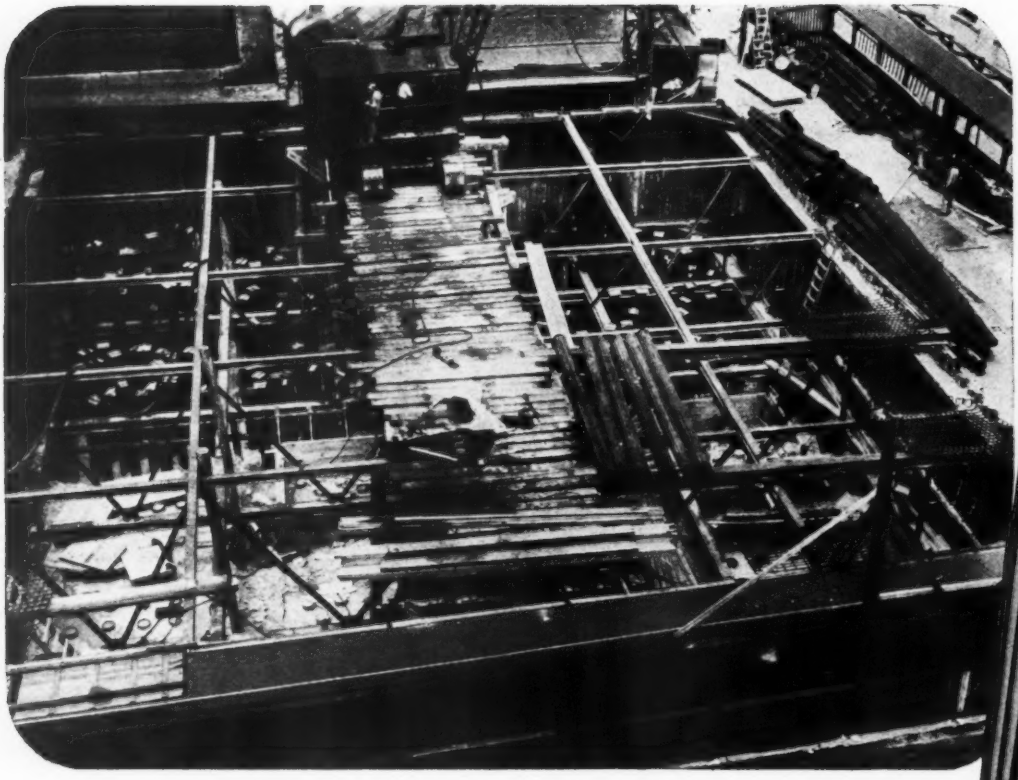
High-Speed, hard-hitting and amazingly husky, yet compact and light in weight, these Hammers are completely self-contained. Operate from Standard A.C. or D.C. outlet or portable generator. Require no transformer or extra equipment. Powered by special Black & Decker-built Universal motors that deliver thousands of sharp, positive hammer blows per minute. And our complete line of Hammer Tools makes them even more useful.

Ask your nearby Black & Decker Distributor for complete information on Hammers and the many other B & D Portable Electric Tools. Write today for our catalog to: The Black & Decker Mfg. Co., 663 Pennsylvania Ave., Towson 4, Maryland.

LEADING DISTRIBUTORS EVERYWHERE SELL

Black & Decker

PORTABLE ELECTRIC TOOLS



How an 18-story building got a good start in life

PICTURED on this page is another major construction project getting a good start—with Monotube tapered steel piles. Approximately 482 seven gauge Monotubes, 25 and 30 feet in length, were used in this foundation for an 18-story office building.

Monotubes were chosen here, as they are on so many jobs, because experienced engineers and builders *know* these tapered steel piles reduce costs . . . save time.

Here's the proof: *Monotubes are light in weight, easily and quickly handled; their fluted, tapered design speeds driving; they are easily extendible, right on the job; their sturdy construction makes it possible to eliminate use of a driving mandrel; Monotubes' tubular construction makes inspection, before concreting, quick and easy.*

Whatever your construction plans —buildings, bridges, piers, airports, highways—plan on Monotubes to make savings for you. Gauges, sizes, and tapers to meet varying soil conditions. For complete information, write The Union Metal Manufacturing Company, Canton 5, Ohio.

We regret the present extended delivery schedules due to the steel shortage, but you will find Monotube Piles well worth waiting for.

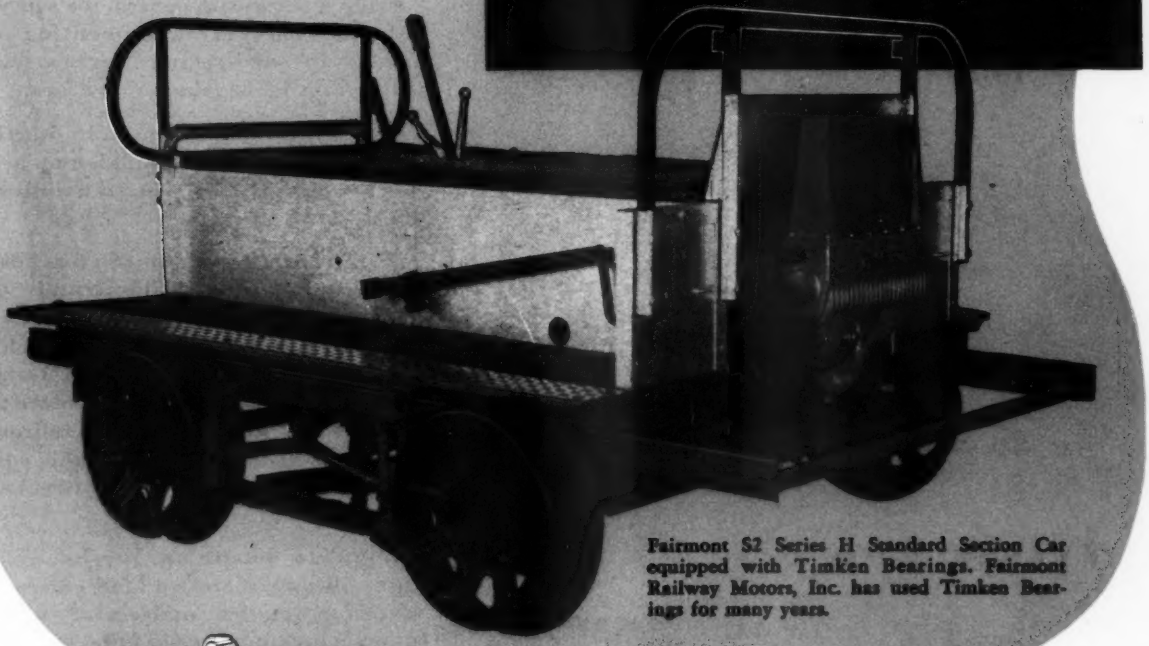
You are cordially invited to visit our exhibit at the
ROAD SHOW
Soldier Field, Chicago
JULY 16 to 24
BOOTH 1007

UNION METAL

Monotube Foundation Piles

For additional information, use postcard, pages 635-636

Availability is ROLLABILITY in Section Cars



Fairmont S2 Series H Standard Section Car equipped with Timken Bearings. Fairmont Railway Motors, Inc. has used Timken Bearings for many years.

TIMKEN Tapered Roller BEARING EQUIPPED

When bearings stop bearing, wheels stop turning, cars stop rolling. Give your cars maximum rollability with Timken Tapered Roller Bearings and they'll have maximum availability — and that's the quality needed most in section cars of all types.

Timken Bearings keep cars out of the repair shop by protecting the running gear against friction; radial, thrust and combined loads; and misalignment.

Wheel alignment is accurately maintained under all operating conditions. Axles last longer because they are not subject to wear. To get all these advantages, see that you get Timken Bearings in your new cars — with the trade-mark "TIMKEN" stamped on every cup and cone. The Timken Roller Bearing Company, Canton 6, Ohio.

TIMKEN
TRADE-MARK REG. U. S. PAT. OFF.
TAPERED ROLLER BEARINGS

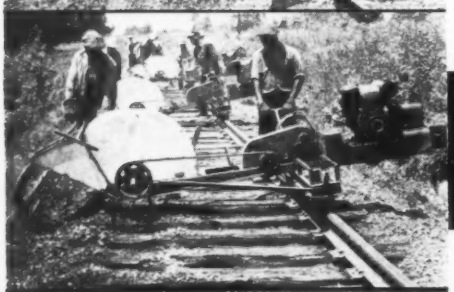
NOT JUST A BALL ◯ NOT JUST A ROLLER ⬭ THE TIMKEN TAPERED ROLLER ⬭ BEARING TAKES RADIAL ◎ AND THRUST →◎← LOADS OR ANY COMBINATION →◎←

5 Kershaw Machines

EACH GUARANTEED

TO CUT TRACKWORK COSTS!

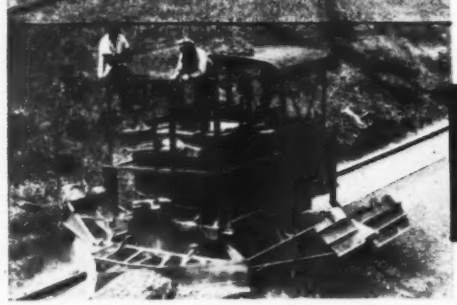
1 KERSHAW "Multi-Wheel Type" KRIBBER



2 KERSHAW "Wheel Type" KRIBBER

3 KERSHAW SPIKE SETTER CARRIAGE

4 KERSHAW UTILITY DERRICK



5 KERSHAW BALLAST PLOW & REGULATOR

From a trackwork contractor's necessity—and years of experimenting with dozens of cost-saving devices—comes this group of Kershaw machines.

Each machine has proved its worth by sharply cutting time and labor on actual track laying, relaying and rehabilitation work.

Many railroads and contractors already have reduced track building and maintenance costs with Kershaw methods and equipment . . . And Kershaw machines are available on a trial-rental basis to prove to your satisfaction that more than 27 years of "working on the railroads" has produced rugged, dependable equipment that has a place in every trackwork program.

Complete details on Kershaw trackwork equipment are available on request. Write for detailed analyses of cost and time savings on successfully completed contracts.

HERE ARE SOME FIGURES!

	Machine	Operation	Saving*
1	Multi-Wheel Kribber	Stripping one mile of track (1 machine—off track)	490 man-hours
2	Wheel Kribber	Stripping one mile of track (2 machines—on track)	203 man-hours
3	Spike Setter	Spikes for 150 rails	32 man-hours
4	Utility Derrick	Setting off equipment on 6 closures (60-man gang)	60 man-hours
5	Ballast Plow	Dressing track—one mile	314 man-hours

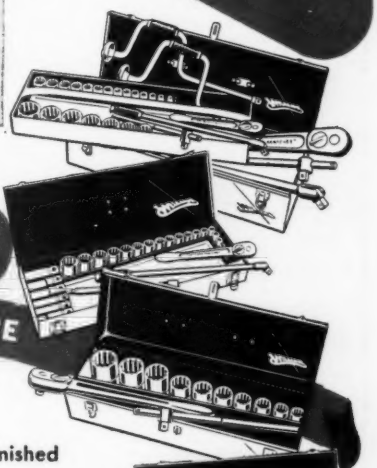
*These are typical savings realized on actual trackwork. Due to regional variations, savings are given in man-hours, rather than dollars. Except for the Utility Derrick figure, none of the substantial additional savings in time and over-all efficiency are given. ALL Kershaw machines will save their cost in from 5 to 10 miles of trackwork!

The Kershaw Co., Inc.

Post Office Box 510
Montgomery, Alabama

Trackwork equipment designed and proved on the job.

NEW "SUPERSOCKET" SETS BY WILLIAMS



"SUPERCHEST" 2001
146 PIECES

51 Sockets • 37 Attachments
58 Wrenches Complete in metal chest with handy tote tray. Openings: 3/16" to 1-5/8" Drives: 1/4, 3/8, 1/2 and 3/4"

35 SCIENTIFICALLY SELECTED SETS FOR EVERY TYPE OF SERVICE

● This new Williams line consists of 35 scientifically matched assortments of various types and sizes of tools, carefully selected and grouped for specific uses. "Supersockets," "Superrenches," pliers, chisels, screw drivers, etc. are included in these many versatile collections.

There are "Supersocket" Sets in 1/4, 3/8, 1/2, 3/4 and 1" drives with socket openings from 3/16" to 2-3/8". The heavy-gauge steel cases are attractively finished in orange and black.

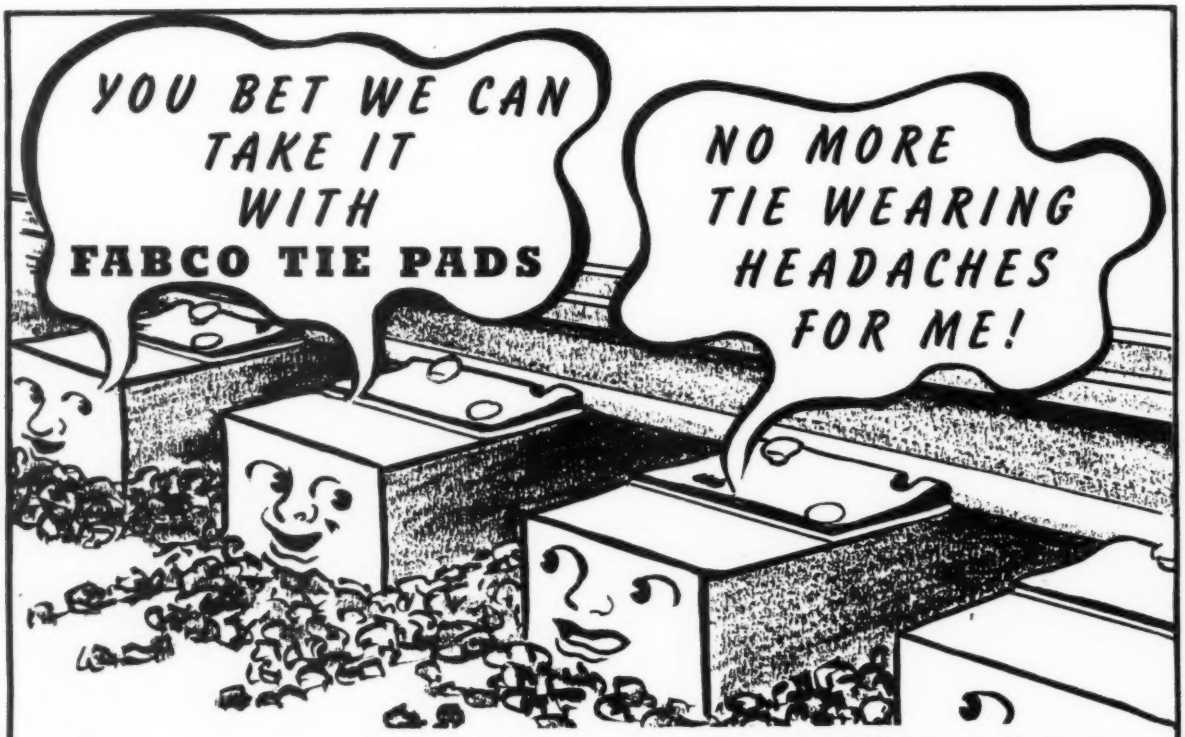
Williams "Superchests" feature removable tote tray, drawers on free action suspension slides and cylinder locks. All cases have convenient compartments that keep sockets at finger tip height. These new sets offer the maximum in convenience, utility and value.

WILLIAMS

• OUR DISTRIBUTOR IS YOUR LOCAL WAREHOUSE

OPEN END, BOX, ADJUSTABLE & RATCHET WRENCHES; DETACHABLE SOCKETS & SETS; IMPACT SOCKETS; TOOL HOLDERS; LATHE DOGS; "C" CLAMPS; CHAIN PIPE TONGS & VISES; FLANGE JACKS; PLIERS; SCREWDRIVERS; PUNCHES & CHISELS; SOFT FACED "NUPLAFLEX" TIPPED HAMMERS; HOIST HOOKS; EYE BOLTS; ROD ENDS; CRANK & BALANCE HANDLES; THUMB SCREWS & NUTS.

J. H. WILLIAMS & CO., BUFFALO 7, N. Y. *Distributors Everywhere*



Now We Can Keep Our NEW LOOK with

FABCO TIE PADS

After seven years of intensive development, FABCO Tie Pads to reduce the mechanical wear of ties in Open Track were made available in January of this year . . . at prices which definitely help reduce the final cost of the ties.

FABCO Tie Pads for Open Track are stocked in 1/4" thickness, in standard tie plate sizes: 7 3/4" x 12"; 7 3/4" x 13"; 7 3/4" x 14"; with other sizes available on special order. They withstand extremes of temperature, moisture, brine, mildew and sand . . . and their limited resiliency, without permanent set, means that spikes do not have to be driven down a second and third time.

- **Prevent Wear of Ties**
- **Resilient — no set — no loose spikes**
- **Long Life — no renewals required**

Get the facts about FABCO Tie Pads Today!

FABCO TIE PADS
Made by
The Makers of Fabreeka

FABREEKA PRODUCTS COMPANY Incorporated

222M Summer Street • Boston 10, Massachusetts

TEAMWORK THAT CUTS MAINTENANCE COSTS

One of the Blue Brute Track Teams at work in the Boston & Albany Railroad yards at Springfield, Mass.

Count on this perfectly matched Blue Brute Track Team to do a lot of fast, efficient tamping, on very little air! The Hand-i-Air Compressor is as tough as they make 'em yet easily handled by two men. Through its easy-breathing Feather* Valves, this tireless, two-wheeled tornado delivers a steady supply of 60 cu. ft. per min. — ample for its four Blue Brute teammates.

They're the WTT-7 Tie Tampers. Men do *more* work with these light, precision-balanced 42-pounders — and do it *easier* and *faster* — while advantages like the leak-proof throttle and anti-freeze design mean tops in efficiency and economy under all conditions.

Adding up, here's teamwork that will surface more lineal feet of roadbed per day — every day. Such performance, remember, is typical of all Blue Brutes — the grouters, contractors' pumps, portable concrete mixers, air tools, etc. — that are cutting maintenance and construction costs all along the line. Checking on them — thoroughly — will be a smart move towards saving money in your own operations.

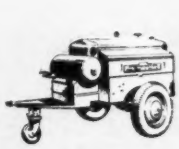
*Reg. U. S. Pat. Off.

H8-4

WORTHINGTON

Worthington Pump and Machinery Corporation, Worthington-Ransome Construction Equipment Division, Holyoke, Massachusetts
Distributors in All Principal Cities

BUY BLUE BRUTES



60' Portable Compressor

Portable Concrete Mixer

Self Priming Centrifugal Pump

Hand Held Air Tools

Railcar Compressor

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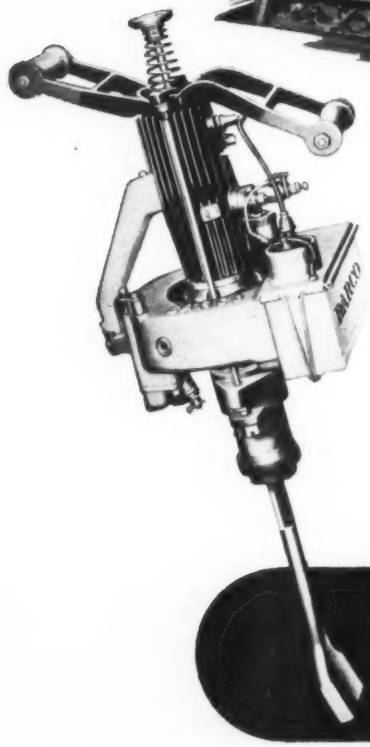

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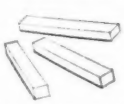

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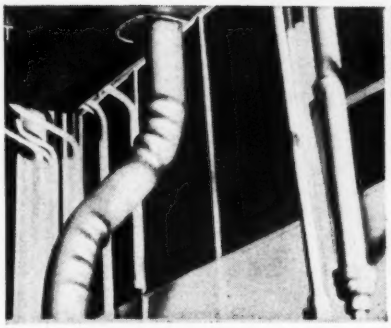

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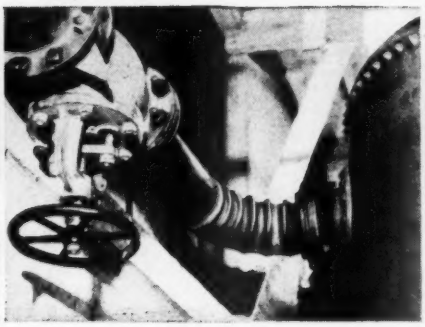

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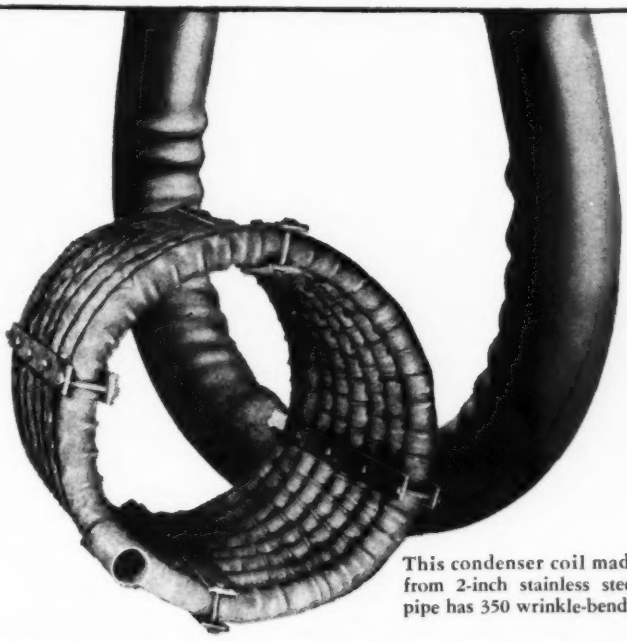

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Railway
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SIMMONS-BOARDMAN PUBLISHING CORPORATION

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Subject: Our "What's the Answer?" Columns

June 1, 1948

Dear Readers:

In the death of George E. Boyd on May 14, reported in this issue, many of you will feel a distinct loss, both personal and through our pages, in spite of the fact that Mr. Boyd had been on a retired status since January 1, 1947. Many of you knew Mr. Boyd best through his conduct of our What's the Answer? columns for 18 years, and through his activities in various railway associations.

Of all his business interests, however, it can be said that the What's the Answer? columns were closest to his heart and his greatest pride. With a background of many years in railway engineering and maintenance work, George Boyd was particularly qualified to conduct these columns, which he did so successfully. But the great interest and value that has been maintained in these columns has been the product of more than the background and experience of one man; more than the interest and devotion of one editor. A still more important factor—and Mr. Boyd would be the first to agree—has been the cooperation of so many of you in suggesting questions to be asked and in contributing so freely to the discussions from month to month. After all, Railway Engineering and Maintenance has merely provided the forum—you have provided the "speakers"—and must continue to provide them if these columns are to continue to be of greatest interest and benefit in the future.

You can be sure that under the direction of Henry E. Michael, associate editor, who is now heading up this department, we will leave no stone unturned on our part to make these columns of greatest value to you. But having already presented nearly 2,600 questions on all phases of track, bridge, building and water service work—all different or with a new slant to bring out new thoughts or developments—and a total of more than 6,700 answers to these questions, you will agree, no doubt, that the problem of maintaining these high standards becomes increasingly difficult.

No one has suggested that there has been any let-down in these columns during the last year and one-half; in fact, many of you have indicated that you have found new freshness and timeliness in the questions and answers that have been presented during this period. But the continued success of these columns—your columns—with maximum value to you, necessarily depends largely upon your continued cooperation—both in suggesting questions that you feel warrant discussion in the interest of yourselves and your fellow maintenance officers, and in contributing freely to the discussions of the various questions raised.

At times we may specifically solicit answers from you, as we have in the past, especially when we know or have reason to believe that you are specially qualified to furnish constructive and enlightening comments. But realizing the inadequacy of this procedure, we earnestly solicit voluntary answers from time to time from more of you—citing your experience or expressing your candid opinions. Maybe there are questions listed in this issue, on page 610, to which you can supply answers.

All of this is with one purpose in mind—the continued high standard, with still further improvement, of our What's the Answer? pages—in your interest.

Sincerely,

Neal D. Howard

NDH:jb

Editor

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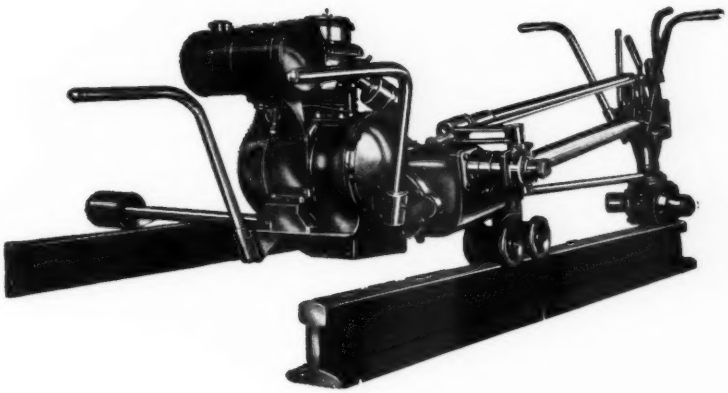

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NAME REGISTERED U. S. PATENT OFFICE

JUNE, 1948

Published on the first day of each month by the

SIMMONS-BOARDMAN PUBLISHING CORPORATION

105 West Adams St., Chicago 3

NEW YORK 7,
30 Church Street

CLEVELAND 13,
Terminal Tower

WASHINGTON, D.C., 4;
1081 National Press Bldg.

SEATTLE 1,
1033 Henry Bldg.

SAN FRANCISCO 4,
300 Montgomery St.

LOS ANGELES 14,
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Subscription price in the United States and Possessions and Canada, 1 year $2, 2 years $3; other countries in Western Hemisphere, 1 year $5, 2 years $8; all other countries, 1 year $7, 2 years $12. Single copies, 50 cents each. Address H. E. McCandless, Circulation Manager, 30 Church Street, New York 7, N.Y.

Member of the Associated Business Papers (A.B.P.) and of the Audit Bureau of Circulations (A.B.C.).

PRINTED IN U.S.A.

Editorials - 591
Labor Disputes—Subsurface Surveys—Service Tests

Burlington Maps Roadbed Conditions with Power Augers - - - - 593
Describes the procedure and equipment used in making preliminary subsurface investigations of sliding fills before applying a remedy

Heat Treating Special Trackwork at the Mill - - - - - - - - - 596
Tells how the Bethlehem Steel Company increases wear resistance of crossings, frogs and switches manufactured at its Steelton plant

Hydrants for Watering Coaches on the C. & N. W. - - - - - - - 598
Descriptions of overhead systems and above-ground, insulated boxes, designed to meet the U.S. Public Health Service regulations

Special Pier Design Helps Solve This Bridge Problem - - - - - - 600
For this job the L & N. adopted concrete caps on composite piles so located that they could be driven in the clear of the spans

How to Get Better Concrete—Proportioning the Mix - - - - - - 603
In the third of a series of articles A. J. Boase explains, in detail, how the proper amounts of cement, water and aggregates are determined

British Test Prestressed Concrete Ties - - - - - - - - - - - - 606
Faced with a shortage of home-grown timber, the English railways are trying out an alternative showing attractive possibilities

Yesterday and Today in Official Inspection Cars - - - - - - - - 609
Photographs illustrating the evolution that has taken place in these units on the Missouri-Kansas-Texas since 1917

What's the Answer? - - - - - - - - - - - - - - - - - - - 610

Laying Rail with Two Gangs
Renewing Ties Before Laying Rail
Aluminum in Railway Buildings
Using Decay-Resisting Primers
Giving Bridge Shoes Good Bearing
Desirable Tie Plate Bottoms
Maintaining Curves for Diesels
Trucks for Water Service Men

Products of Manufacturers - - - - - - - - - - - - - - - - - 617

What Our Readers Think - - - - - - - - - - - - - - - - - - 620

The Month's News - 622

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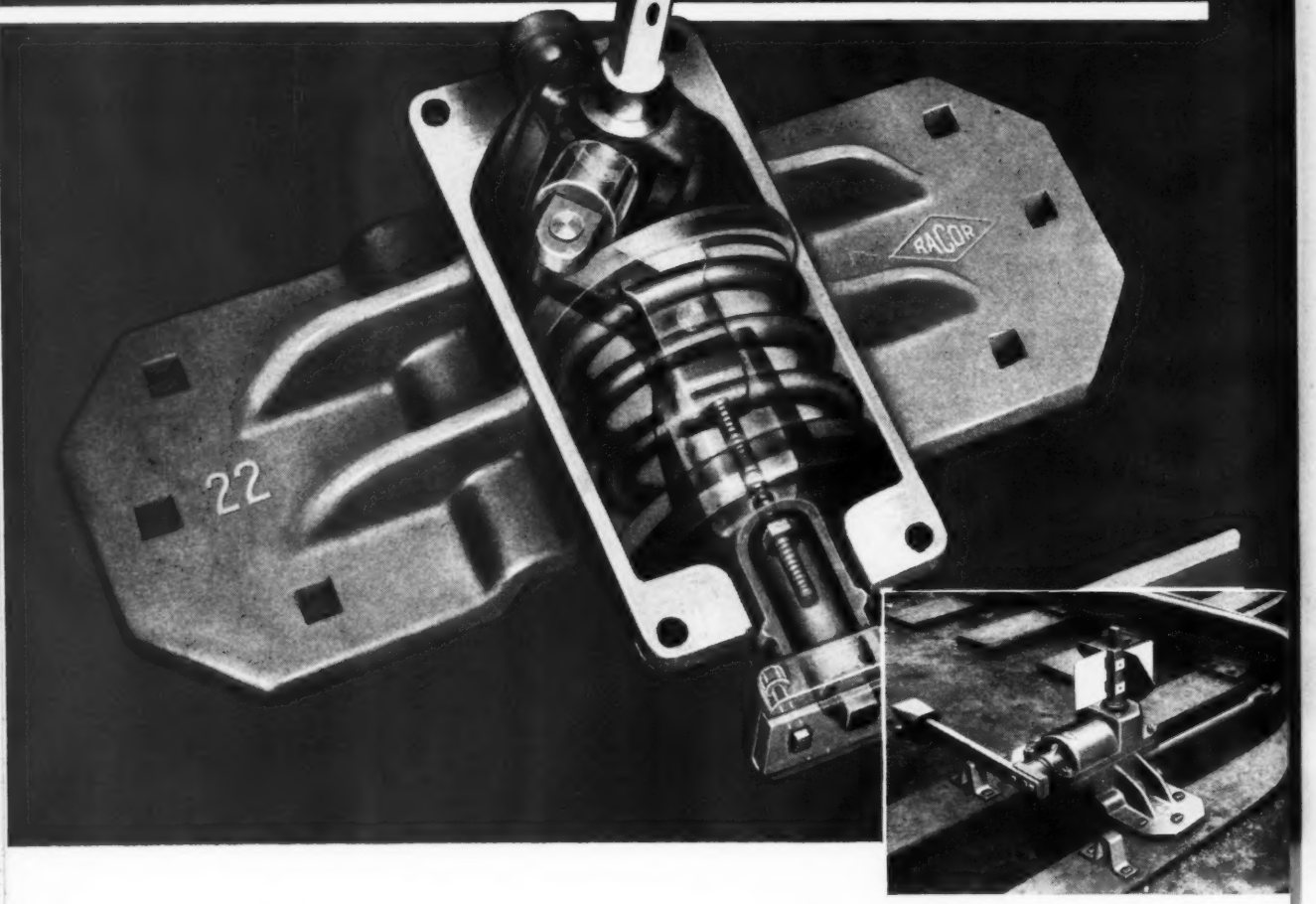

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Railway Engineering and Maintenance

Labor Disputes—

Cannot Be Allowed to Cripple the Country

On May 10, when the nation was threatened with imminent paralysis of its railway transportation systems as the result of a strike called by the leaders of three operating unions, the federal government, by executive order, took over the railroads, secured a restraining injunction, and brought the strike threat to a halt.

It was a narrow escape for the American people, and, indeed, for the peoples throughout the world, because a prolonged shutdown of the American railroads could have crippled agriculture, industry and commerce in this country and have had inestimable repercussions abroad. It was likewise a narrow escape for the three railway unions involved—the Brotherhood of Locomotive Engineers, the Brotherhood of Locomotive Firemen and Enginemen, and the Switchmen's Union of North America—and for labor as a whole, because all stood the possibility of irreparable damage to their cause.

A crippling strike, bringing chaos to the country in such crictical times, could not have been permitted—it was not permitted—and public sentiment is so crystallized against such a possibility that a nation-wide strike on the railroads may never again be allowed to occur.

For the second time in as many years the nation has been faced with a major railroad strike. In May, 1946, it was the Brotherhood of Locomotive Engineers and the Brotherhood of Railway Trainmen who held out against the recommendations of a Presidential fact-finding board—after a dispute had run the gamut of means for the peaceful settlement of disagreements provided for in the Railway Labor Act; and a short-lived strike actually occurred. In the more recent instance, following the same pattern, it was approximately 125,000 enginemen, firemen and switchmen, representing less than 10 per cent of all railroad employees, who threatened the nation-wide walkout. The trainmen and conductors, as well as about one million non-operating workers, along with railway managements, had accepted the board's proposal of a 15½ cents-an-hour wage increase, plus concessions in working rules in some cases.

The American public finds a real place for properly conducted unions in the American way of life. To the extent that unions live for the welfare of their members and to protect them against abuses by industry, while not persecuting the public in so doing, they serve a useful purpose—and many unions have an enviable record in this regard. But when unions, in utter disregard of the public welfare—indeed the national welfare—seek selfishly to gain their own ends, regardless of the consequences, they quickly lose public good will and esteem.

The laws of the United States assume that some industries are naturally competitive and some naturally monopolistic. These laws prohibit the former industries from forming monopolies or adopting monopolistic practices. At the same time, the laws prevent industries presumed to be naturally monopolistic, such as the railroads and public utilities, from using the power of monopoly to the disadvantage of the public—by subjecting them to strict government regulation of their services, rates, accounting, financing and other phases of their business. The abuses of monopolies in past years have brought on the generally accepted rule of either no monopolies in industry or closely regulated monopolies—a rule which has proved to be in the public interest.

But whereas monopolies have long been associated only with business and industry, the public is coming to learn that just as unfair or destructive monopolies can exist in labor unions, and there is now overwhelming

public sentiment to protect the people as a whole from the abuse of the power inherent in such monopolies. Some proposals have had the purpose of destroying labor monopolies outright. Others would closely regulate them in the public interest. The former would abolish the monopolies by prohibiting nation-wide membership in unions. The latter would control the monopolies by prohibiting strikes that would cause territory-wide or nation-wide shutdowns of vital industries. If either of these restrictions come, labor can blame no one but itself. And restrictions will come, if necessary, because the public is becoming increasingly "fed-up" with the "big stick" of labor groups which would sacrifice the welfare of *everyone else*, to gain their own ends.

It is to be hoped that the good judgment inherent in railway labor as a whole, and exhibited by non-operating employees (including those in the maintenance of way and structures department) in particular, will prevail and make unnecessary drastic restrictions on railway labor unions. That employees will have grievances and will make demands is inevitable, but means *must* be found to settle these disputes without resort to steps that will paralyze the nation. The existence of monopolies, large or small, whether in business or labor, so powerful and arrogant that they can shut down entire industries vital to the public welfare, or otherwise completely disregard the public interest, is contrary to the American way of life—and cannot be tolerated.

Subsurface Surveys—

Needed as Guide for Stabilization Work

ROADBED stabilization work has become a major activity of the track maintenance forces. Each year large sums are spent for grouting, pole driving, the installation of subsurface drainage systems, and other expedients for correcting unstable track. To what extent are these large expenditures based on the results of adequate scientific subsurface investigations to determine the corrective measures best suited to particular conditions, and to serve as a guide in assuring that effective and economical installations will be made?

It is widely recognized, of course, that a knowledge of subsurface conditions is desirable at locations where roadbed stabilization work is contemplated. For this reason many railroads make a practice of conducting sub-soil investigations before undertaking such work. However, the scope and accuracy of these investigations are frequently limited by the equipment or other means used in making them. For instance, the use of hand-operated bars or augers for making soundings is a back-breaking job that permits only limited penetrations to be achieved. Also, the tedious and costly nature of hand methods is apt to impose restrictions on the number of soundings made.

When stabilization work is carried out that is based on inadequate or inaccurate information regarding the conditions to be dealt with it must be expected that the results will sometimes prove disappointing. In fact, instances have been recorded of shoulder poles that were not driven deep enough to prevent their being carried along with sliding material, and of drainage pipe not properly located. Even more serious is the danger that entirely inadequate measures will be decided on, or, on the other hand, that extensive work will be done where actually little or none is needed.

The Chicago, Burlington & Quincy seems to have found an effective answer to this problem. As explained in an article starting on the opposite page, this road has devised a method of making exhaustive subsurface investigations, based on the use of power augers for making soundings, as a result of which accurate and exhaustive information is obtained as a guide in designing corrective measures.

Service Tests—

Must be Conducted on Systematic Basis

TEST installations have long been used by the maintenance forces, frequently in cooperation with supply companies, as a means of arriving at conclusions regarding the merits of new or improved materials, devices and machines. It can hardly be expected, however, that the best results will be realized from such tests unless they are conducted on a scientific basis, including careful selection of the location of the test, proper attention to all pertinent details involved in making the installation, and, thereafter, periodic inspections made by competent persons, with accurate records being kept of the observations made during the inspections.

The many field tests being conducted under the direction of the research engineer of the Engineering division, A.A.R., afford examples of the scientific approach in making such tests. But what about the many test installations made by individual railroads? Are they always conducted in a careful and systematic manner?

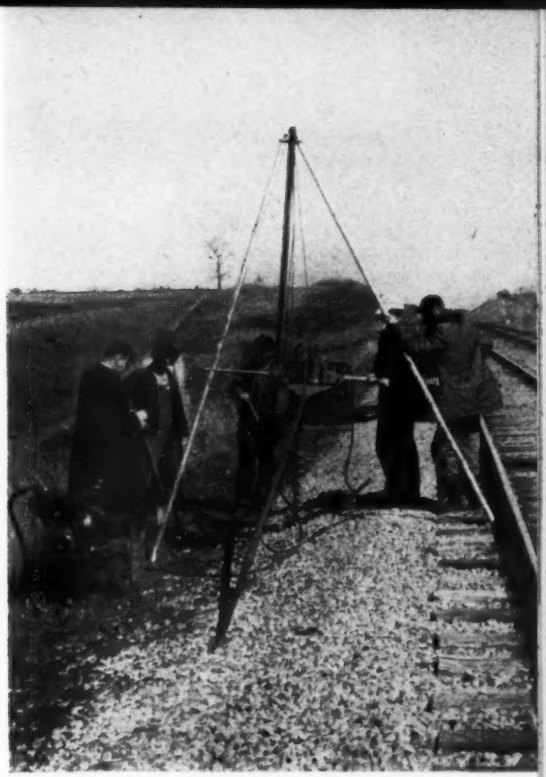
Unfortunately, in many cases the answer to this question must be in the negative. Too often it happens that inspections of test installations are conducted on a sporadic or haphazard basis. Too frequently the all-important factor of keeping adequate records of the inspections is neglected. The result is that at the conclusion of a test—if, indeed, it is ever carried to a conclusion—little data are available on which to base a decision regarding the efficacy of the product tested.

With these thoughts in mind there would seem to be considerable merit in a system worked out recently by a supply company for making service tests of several new products it had developed. Under this scheme the locations of the tests are carefully selected, and installations are made under agreements with individual roads providing for periodic inspections to be made jointly by representatives of both the supply company and the railroad. Comprehensive forms have been devised for recording all essential information regarding each installation and for keeping accurate records of performance, as developed during the inspections.

Using this system information will ultimately become available that will permit accurate conclusions to be drawn regarding the performance and economy of the products under test. It would seem that both the railroads and suppliers would gain benefits if such careful control of test installations were to become the rule.

Burlington Maps Roadbed Conditions *with Power Augers*

To obtain a comprehensive picture of the internal structure of unstable roadbeds, primarily sliding fills, in order to determine the most effective and economical remedy, the Chicago, Burlington & Quincy has adopted the practice of making exhaustive preliminary subsurface surveys, using auger-type power drills. This article discusses the various types of investigations made by such means, and gives details of the equipment used and the organization set up to operate it.



View showing the equipment used by the Burlington in making preliminary subsurface investigations of roadbeds. The operations are carried out by four men including a rodman who has supervision of the work

THE perfecting on the Chicago, Burlington & Quincy of a system for making preliminary subsurface investigations, based on borings made by power augers, has eliminated guesswork on this road regarding the cause and cure of sliding fills. When the data assembled by this means have been charted, a complete and accurate picture of the internal structure of the roadbed is available for analysis. From this picture the reasons for failure are readily apparent, and scientific decisions can be made as to the most effective and economical remedy. An important feature of the system is the equipment used, which consists of 6-in. motor-driven power augers, each supported by a tripod when in operation, and powered by a portable motor-generator set.

Formerly Used Hand Methods

In common with many other roads the Burlington formerly relied on hand-operated augers for making subsurface investigations on fills. However, because of the limitations of this method, as regards both the speed of the work and the practicable depth of penetration, it was not possible to obtain a comprehensive picture of the subsurface conditions to the depth required for satisfactory results. Therefore, the railroad turned to the use of power augers on a systematic and comprehensive basis as described in this article.

Developed originally in the course of studies of unstable fills on parts of the road in Iowa and southern Illinois, the practice of making subsurface surveys has now been adopted by the Burlington as a preliminary step in all embankment stabilization work. Further application of the practice has been extended to cover investigations in connection with proposed line changes, the design of foundations, including pile penetrations, and many other situations in which accurate knowledge of subsurface conditions is important. In the case of line changes the practice is to make borings at intervals of 100 ft. along the center of the proposed line. If there is a choice of several different alinements, final selection is governed to an important extent by the results of the subsurface investigations.

During 1947 the Burlington used power augers in making studies at 17 different locations at an average cost of $0.292 per drilled foot. Increased efficiency in the use of the equipment has reduced this cost to a lower figure at the present time, in spite of increased labor costs. In any event, the Burlington considers the cost of drilling as negligible in view of the important benefits obtained.

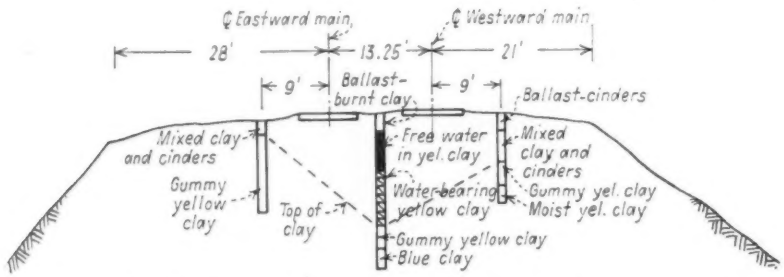
How the Studies Are Made

In making a typical investigation of a sliding fill, the locations for the borings are selected in such a manner that, when the logs of the holes are plotted, it is possible to develop cross sections and longitudinal profiles which show the position of all underlying strata and cleavage planes having a bearing on surface conditions. The points for borings are selected to cover not only the actual slide area but also a considerable stretch of the fill in each direction.

Generally the borings are made 100 ft. apart, at the chaining stations, except in the actual slide area and when water is encountered. In the slide area a section is taken at each end of the slide and one at the center. At water pockets a sufficient number of holes are drilled to locate their limits accurately. In double-track territory three holes are drilled at each station, one on each shoulder at opposite sides of the fill, and the third at the center of the fill between the two tracks. In the case of single-track lines three holes are usually drilled at each station, one at each end of a tie and one in the center of the track. If considered advisable in either case, additional holes are drilled on the slope of the embankment in line with those on top.

As each hole is drilled the material raised on the auger is classified and located as to its depth below the top of tie. When the drilling operations have been completed the log of each hole is plotted on external cross sections and profiles of the roadbed in order to show the location and nature of the different subsurface strata which can be reached with the auger.

Of particular importance is the location of a clay stratum underlying porous material through which surface water may percolate to contact and soften the clay. Since slides are generally caused by the action of the horizontal component of the weight of the material overlying an inclined clay plane which has become softened



Illustrating how the data obtained from the boring are plotted on a cross section

and lubricated by water, close attention is given to the presence and inclination of such planes in interpreting and analyzing the surveys. Cross sections taken in actual slide areas have almost always shown a sharply inclined clay stratum. Because of the importance attached to these clay planes their presence is indicated by lines drawn on both the cross sections and the profiles. On occasion, lines are also drawn showing the planes formed by other materials, such as rock, if this seems desirable. Other pertinent data shown on the plottings include the locations of drains, piling and culverts.

Remedy Can Be Decided

With all this information in hand the nature of the most effective and economical remedy for each particular location can readily be decided. In those cases in which the slide-piling method is deemed sufficient, the lengths of piling required and their proper location for maximum effectiveness can be accurately determined. Since the locations of water pockets are plotted, the proper locations, elevations and grades for pipe drains can be readily established. When stabilization by pressure grouting is considered most suitable, the proper locations for grout injection can be selected, and, in many cases, an estimate of grout acceptance can be quite accurately determined.

In the course of numerous investigations by this method, many interesting situations have been brought to light, particularly in the case of fills with a long history of instability in which different remedies have been tried with varying degrees of success. In such instances, surveys by drilling have often revealed the reasons for the failure of some of these remedies. For example, in some cases shoulder poles had been driven which were too short to penetrate into the clay stratum, with the result that slides occurred which carried the poles along with the sliding material.

In other cases it was revealed that existing drainage systems were ineffective because the pipes had been installed at the wrong places or too high. It is believed that, if thorough and systematic surveys by soundings could have been made originally, the expense of these ineffective drains could have been avoided, or a better installation made. Another aspect of the use of these subsurface investigations is that they frequently constitute a safeguard against expenditures for large-scale stabilization work when actually only minor corrections are necessary.

The 6-in. auger-type electric drills used in making these investigations are manufactured by Ka-Mo Tools, Inc., Chicago. Each of three such units now in operation includes an electric motor for driving the auger, which is suspended by a block-and-tackle arrangement from the apex of a tripod, the legs of which are made of aluminum tubing. The current for operating the motor is in each case supplied by a portable motor-generator set consisting of a United States generator driven by a Briggs & Stratton gasoline engine. The motor-generator set has a two-wheel rubber-tired mounting. A heavy-duty cable, 50 ft. long, carries the power to the motor.

Torque Arm Prevents Turning

To facilitate the carrying of the motor, and for use in preventing it from turning when drilling, two extension handles are provided. As an additional safeguard against the rotating of the motor when difficult drilling conditions are encountered, an anchor is furnished in the form of a torque arm. This unit is a length of metal tubing one end of which is attached to the motor mounting, while the other end extending out some distance from the auger, is embedded in the ground or the ballast. To prevent the torque arm from throwing the auger out of line as the latter penetrates the roadbed, the arm is made in two sections, with a sliding joint which permits the arm to become shorter as the motor moves closer to the surface of the ground.

The auger is furnished in 4-ft. sections, which are pin connected. As the drilling of a hole progresses, additional sections are added until the desired depth is reached. The end section is fitted with a cutting point which loosens the material and feeds it to the auger.

With this equipment it is also pos-

Making a boring in the intertrack space on a double-track fill

sible to drill horizontally into the sides of a fill if desired. When dismantled the entire unit can be transported on a motor car. Ordinarily this equipment is not used for drilling to depths greater than about 30 ft., although, in some instances, depths of as much as 40 ft. have been reached.

Each drilling outfit is operated by a crew of four men, including a rodman from the engineering department who supervises the work. In addition to his supervisory duties, the rodman determines the drilling points, takes the log of each hole and does all the drafting work necessary in connection with each project. The 1947 drilling cost of $0.292 per foot, mentioned previously, includes the wages of these four men, a charge for "rental of equipment," the cost of gasoline and oil for the engine, and all maintenance costs.

Examples Show Procedure

A specific application of the procedure is demonstrated by a recent job on the Creston division near Red Oak, Iowa. At this location the double-track main line is carried on a high fill with a history of instability. On this job sections were drilled at intervals of 100 ft., except at the old slide areas and at water pockets, where the borings were spaced closer together. At the location of each cross section three holes were drilled, one in the inter-track space and one on each shoulder of the embankment at a distance from the center line of the adjacent track varying from 7 ft. to 11 ft.

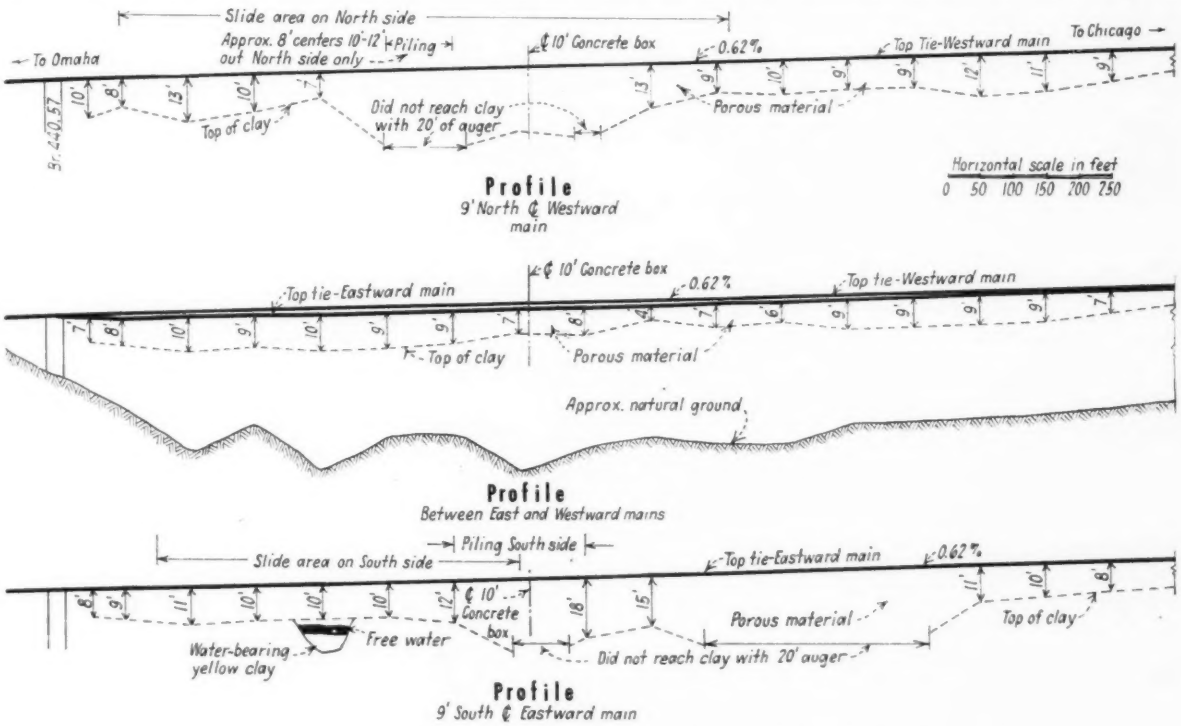
When the logs of the holes were plotted they revealed the existence of a stratum of clay, the top surface of which presented a variety of situations. In some sections this surface was level. In others it had a slope in one direction entirely across the fill section. In still others the clay stratum came to a ridge at the center of the fill, or formed a valley along the center line, in which impounded water was usually found. The longitudinal profile of the top surface of the clay stratum showed that the depth of this stratum below the top of tie varied from 5 to 10 ft. along the center line of the fill, while at the shoulder line on each side the depth varied from 1 ft. to more than 20 ft. When this survey had been analyzed it was decided that, in view of the conditions encountered and the heavy traffic and importance of the line, an attempt to stabilize the line by pressure grouting was economically justified.

Job Near Knoxville

Another specific application of this method of making subsurface investigations is demonstrated by a job on the single-track Albia-Des Moines line near Knoxville, Iowa. At this location there were two bad slides in the vicinity of a reverse curve. Soundings were taken in sections extending from the existing roadbed to an area in which a new line could be located —a distance of approximately 400 ft. At the slide locations on the old roadbed, the survey revealed an inclined clay stratum underlying porous materials and overlying a stratum of rock, of which the surface was approximately parallel to that of the clay. A considerable amount of water was found in the porus material.

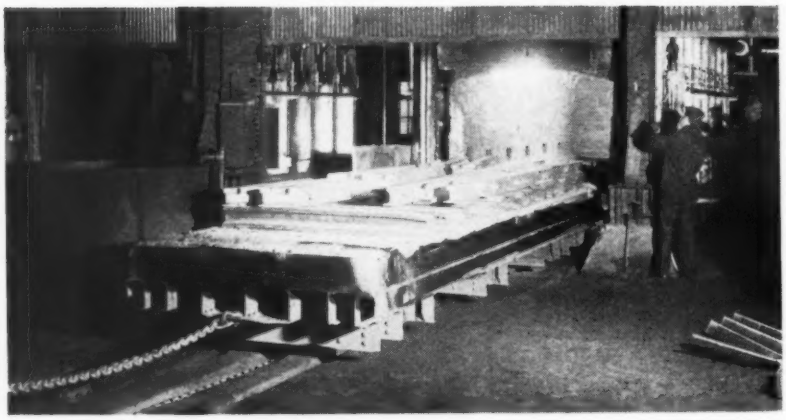
At the same time the soundings showed that beyond the existing roadbed, in the area where a new line could be located, the subsurface conditions were more conducive to stability and otherwise more favorable for the construction of a new line. On the basis of this survey it was concluded that an attempt to stabilize the existing roadbed was not economically justified, and that a line change offered greater promise of an effective solution to the problem.

The method of making subsurface investigations as described in this article was developed by the engineering department of the Burlington under the general direction of H. R. Clarke, chief engineer, and E. J. Brown, engineer of track. A. W. Schroeder, assistant to engineer of track, has direct supervision of the work.

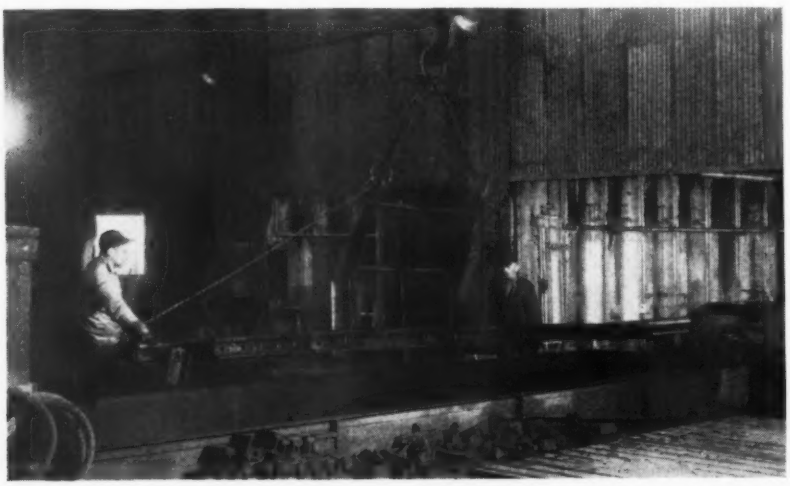


Showing how the profile of the top of the clay is plotted on the track profile, along with other data

Heat Treating Special Trackwork



Above—Crossing parts emerging from furnace ready for the quenching operation. Below—An assembly being lifted from the quenching tank. Note test piece bolted to end of rail



Below—After being quenched the crossing parts are placed in a furnace for tempering

HEAT treatment of special trackwork—crossings, frogs, and switches—was started a number of years ago at the Steelton (Pa.) plant of Bethlehem Steel Company, after exhaustive studies of the chemistry of rail steel and the requirements of the track structure. In the process employed the entire cross-section of the assembly is hardened and toughened uniformly by an oil quench, followed by a tempering operation.

Two treating units are available, one for small and medium-sized assemblies, and the other for the larger units produced. The first of these includes two car-bottom furnaces of identical size and construction, one for heating prior to quenching, the other for tempering. These furnaces are 23 ft. 9 in. long and 6 ft. 9 in. wide and are each equipped with twelve burners, six on each side. They are fired with oil or coke-oven gas, with manual regulation of each burner. Careful temperature control is maintained by means of four themocouples.

Quenching is carried out in a rectangular tank 24 ft. long, 6 ft. wide and 6 ft. deep. The heated assemblies are lifted from the car bottom by means of a spreader and lowered into the quenching bath. Extra care is taken to speed this transfer. During the quenching period the loaded spreader is rocked gently, and the oil is circulated through a cooling system to maintain the temperature required for treatment.

The quenched pieces are removed from the oil bath while still warm and placed in the tempering furnace in which the temperature is about the same as that of the steel. The furnace is then slowly brought up to full heat and maintained at the desired tempering temperature for the specified length of time. Finally the assemblies are cooled down with the furnace to a point where they may be taken out without any danger of harmful thermal stresses.

Long switch rails are treated in a longer unit consisting of two car-bottom furnaces, each 58 ft. long and 6½ ft. wide, and a rectangular quenching tank 50 ft. long, 8 ft. wide, and 6 ft. deep. The operation of this unit is similar to that of the smaller unit in all respects.

Brinell hardness checks are made on test pieces from every treatment

at the Mill

The plant of the Bethlehem Steel Company at Steelton, Pa., is provided with equipment by means of which crossings, frogs and switches manufactured at this plant may be subjected to carefully-controlled heat treatment in order to increase their resistance to wear. In this procedure the units, some of which are first assembled with temporary bolts, are heated in a special furnace, quenched in an oil bath, and tempered in a similar furnace. The equipment and procedure are described in this article.

After heat treatment the parts are cleaned by shot blasting

charge. These pieces are attached to the assemblies and go through all operations. By varying the chemical composition and the treatment cycle different Brinell hardnesses are obtained to suit the various demands.

Rails to be fabricated into crossings are laid off to dimensions, cut to length on one of three cold saws, and planed to size. Suitable fillers are also sawed to length and planed in the same shop. The planed rails and fillers are placed on assembly beds where they are marked and assembled for drilling. After being drilled the rails and fillers are returned to the assembly beds where they are assembled to the proper alinement with temporary bolts and made ready for heat treatment.

After heat treatment the crossings are disassembled and scale is removed in a shot-blasting room. Most lengths, especially the larger ones, require some straightening after the treatment. After final assembly the crossings go to the layout floor for inspection. The procedure used in the manufacture of bolted-rail frogs is practically identical with that for crossings.

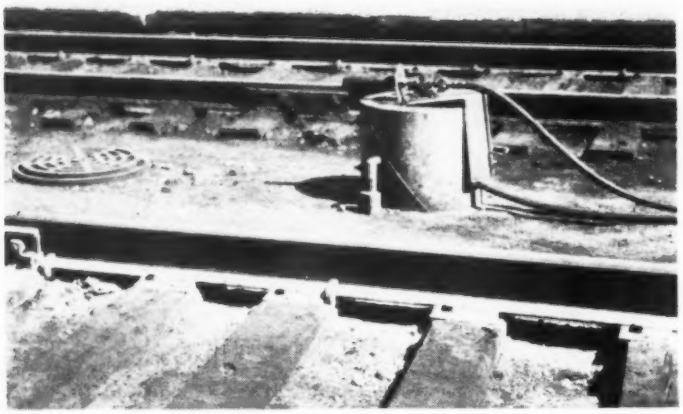
The fitting-up bolts used in heat treatment are considered temporary and are never used in the final assemblies. All bolts used in the final assemblies are heat treated.

In the production of switch points the rails are usually heat treated before any machining work is done. After being heat treated such rails are straightened in a press. Short lengths must generally be cleaned by shot blasting; the longer pieces, however, are descaled during the straightening operation.

The cleaned and straightened rails are laid out and assembled with reinforcing bars. Then all rivet and bolt holes are drilled through the rail and reinforcing bars in one operation on a horizontal, multiple-spindle drill press. When the riveting and bolting of the pieces are completed, the alinement and vertical bends are put in on a press. The pieces are then planed, and afterward the assemblies are taken to a press to remove planing distortion and to give them proper alinement and curvature. Sockets, clips, and other parts are then attached, an accurate contour is ground at the extreme point—and they are ready for inspection.

One of the stations where frogs and crossings are assembled before and after heat treatment

Hydrants for Watering Coaches on the C. & N. W.



One of the platform-height hydrants with self-closing cover at Clinton. The catch basin at the left was formerly a flush-type, timber hydrant box

The new regulations relating to equipment used in supplying passenger cars with potable water impose upon the railroads the problem of providing economical coach-watering facilities in which the danger of contamination is eliminated. In meeting this problem the Chicago & North Western has developed two different designs, one of which embodies a complete overhead system, utilizing existing station platform canopies as a support, while the other involves the use of insulated hydrant boxes extending above ground.

TO conform with the new interstate quarantine regulations of the United States Public Health Service governing equipment used in supplying railway passenger cars with potable water, the Chicago & North Western has developed two different designs of coach-watering facilities which have proved to be effective and economical in several recent installations. One of these designs embodies a complete overhead system, utilizing existing station platform canopy roofs as a support, while the other, for use with underground supply lines, consists of hydrant boxes made of double steel pipes, with rock wool packed between the inner and outer pipes for insulation.

The type of installation most highly favored by the Public Health authorities is a complete overhead layout, in which the danger of contamination is practically eliminated. In the course of studies as to the manner in which an overhead system could be supported, the North Western decided that existing canopies, if conveniently situated, could be utilized for this purpose. Hence, when making recent installations at Sioux City, Iowa, and Madison, Wis., at which points the station layouts included platform canopies, the overhead design was adopted.

At Sioux City

The Sioux City canopy is 500 ft. long over a station platform located between the main track and the first of four stub-end coach tracks. It has a flat roof sloped slightly for drainage into a gutter along one side, by means of which rain water is carried to cast-iron downspouts at the canopy posts. These posts are arranged in a single row along the center line of the platform on 16-ft. 8-in. centers.

The new coach-watering facilities include a 1¼-in. water line and a ½-in. steam line (the latter for frost protection), both of which are laid in a wood-box conduit on the roof of the canopy, directly over the line of posts. The steam line is connected to the station heating system. The conduit, with sides constructed of 1½-in. lumber, is 8¾ in. by 8¾ in. (outside dimensions) in size. To guard against the development of leaks in the roof of the canopy below the conduit, flashing is provided between its sides and the canopy roof.

Valve boxes are provided on the roof of the canopy at intervals of four canopy bays, at each fifth post, which are also constructed of 1½-in. lumber. These are 15-in. wide, 12 in. long and 11 in. deep (outside dimensions). Each valve box contains a 1-in. globe valve, tee-connected to the water line. Joined to the outlet of each valve by a 90-deg. elbow is a length of 1-in. pipe which extends downward through the valve box and canopy roof, directly alongside a canopy post. The lower end of this pipe is located at a point 5 ft. above the platform, convenient for a standing workman, and has a quick-acting coupling to which the coach-watering hose is connected.

To provide means to operate each of the roof-located supply valves from the ground, a ½-in. metal extension rod is welded to the valve stem. This extension projects downward from the valve through the valve box and canopy roof, terminating in a valve wheel at a convenient height above the platform. The section of the rod which passes through the roof timbers and the valve box is enclosed in a ¾-in. pipe. When a supply valve is closed the outlet pipe and hose may be drained into the adjacent canopy downspout. To permit this, a funnel-shaped catch-drain is tapped into the downspout below the quick-acting coupling.

The Madison Facilities

In making the overhead installation at Madison some modification of the Sioux City design was necessary because of a different type of canopy construction. At Madison the canopy has a peaked roof supported on transverse steel roof trusses spaced 20 ft. apart. The trusses are supported on posts arranged in a single row along the center line of the platform. For this type of canopy the pipe conduit is designed to rest on the lower chords of the roof trusses adjacent to the canopy posts. Additional conduit support is provided by single ¾-in. hanger rods placed midway between the trusses. Each of these rods is hung from two 2-in. by 6-in. timbers installed between adjacent I-beam roof joists.

The conduit at Madison consists of two wood boxes, one inside the other. The inner box, with outside dimensions of 6 in. by 6 in., contains a 2-in. water line and a 1-in. steam line supplied by the station heating plant. The

outside dimensions of the outer box are 12 in. by 12 in., and the space between the two boxes is packed with rock wool for insulation. In other respects, insofar as the overhead system is concerned, the Madison facilities are essentially similar to those at Sioux City. It was, however, necessary at Madison to construct a number of above-ground type hydrants supplied by underground pipe lines beyond the limits of the canopies. In design, these hydrants are similar to those installed recently at Clinton, which are described in the following.

The Clinton Installation

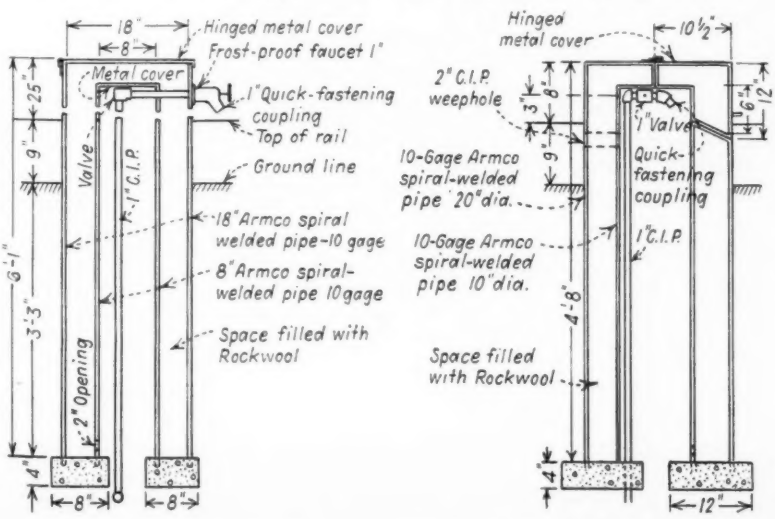
At Clinton, the original coach-watering facilities at the station consisted of flush-type hydrants in timber housings. It was necessary to renew these facilities at the close of World War II, and in so doing the present hydrant boxes were installed. Since a majority of the new hydrants were to be installed in the vicinity of the low station platforms, between two main tracks, it was decided to limit the height of such hydrant boxes to that of the station platforms, or 8 in. above top of rail.

With the height of the hydrant boxes thus limited, it was necessary to design them with self-closing covers to conform with the new interstate quarantine regulations of the U. S. Public Health Service. The project also called for the installation of hydrants beyond the limits of the station platforms, where conditions were such that no limitations were imposed upon the height of the boxes.

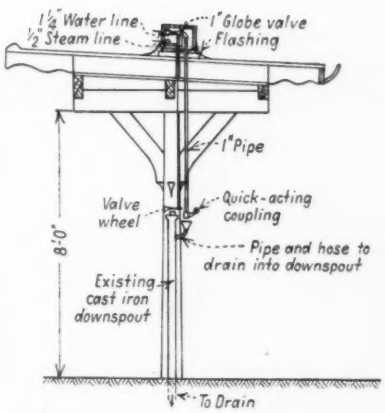
To meet these varying conditions, two different designs of boxes and hydrants were adopted. Although basically the same, the two types differ in diameter, height and in details of the hydrant outlet. In the case of the type constructed between the main tracks, the riser pipe, valve and coupling are all enclosed in a section of 10-in., 10-gage, Armco spiral-welded steel pipe sunk into the ground 3 ft. 6 in. in a vertical position. The 10-in. pipe, in turn, is enclosed in a section of 20-in., 10-gage pipe, of the same kind, extending 3 in. higher than the inner pipe. Both sections of pipe are supported on a concrete pad 4 in. thick. The space between the inner and outer pipes of each hydrant box is packed with rock wool for insulation. For additional frost protection, each hydrant is provided with an electrical heating coil wrapped around the riser pipe. This coil is connected through the side of the hydrant box to the regular platform lighting circuit, and operation of all of the heaters is controlled by thermostat. Each hydrant box is provided with a 2-in. cast-iron weephole through both the inner and outer casing at a point 12 in. below its top. Another 2 in. weephole is provided through the inner casing just above the concrete pad.

The top end of each pipe forming the hydrant housing is sealed off by a ¼-in. plate, the space between these plates—3 in.—being filled with rock wool. Access to the interior of each hydrant box is provided by an opening cut through a portion of the top and one side, which is closed by a top-hinged, self-closing insulated cover that, on both the top and the side, is flush with the exterior surfaces of the box. All joints in the hydrant boxes are made by welding.

To operate one of these hydrants the cover is lifted and the hose is connected to the valve by means of a quick-fastening coupling. The cover is then closed and allowed to rest on the hose. Since the flow of water when supplying a coach is controlled by a valve at the nozzle end of the hose, comparatively little water is wasted on the ground and, consequently, no special provision was made for drainage.



Drawing showing the two types of hydrants at Clinton. Left—For installation where track clearances were not restrictive. Right—For locations of limited clearance



Drawing showing construction of the overhead facilities installed at Sioux City

Since in the construction of the other type of hydrant at Clinton no limitations for clearance reasons were necessary, the primary considerations in design were safety and economy. In this type the pipe casings are of a smaller diameter, the inner pipe casing being 8 in. and the outer 18 in. For safety reasons the height of these hydrants was made 34 in. above ground, on the theory that there is less danger of tripping in the case of an obstruction which projects above the ground a distance greater than knee height.

Frost-Proof Faucet

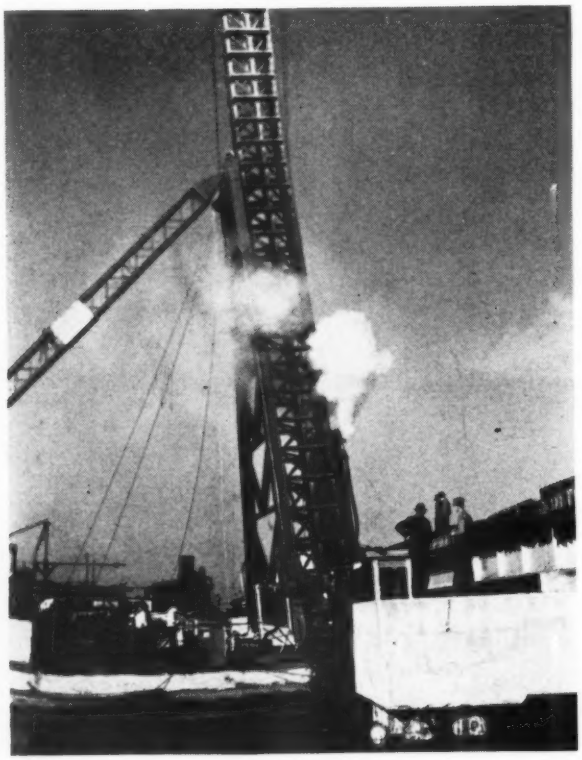
The valve is enclosed in the inner casing, but the need for a self-closing cover was eliminated by projecting the hydrant faucet outside the box. The faucet is of a frost-proof type and is equipped with a quick-fastening coupling. The top of each box is provided with a cover which can be removed if internal repair work becomes necessary.

After the new system was placed in operation, the old hydrant boxes were converted into catch basins by removing the water connections and applying catch-basin covers. The bottom of each of these old boxes was already connected to a 6-in. tile drainage system.

The plans for and installation of the various facilities described were made by the division forces under the general direction of E. C. Vandenburgh, chief engineer and under the direct supervision of B. R. Meyers, assistant to chief engineer.

Special Pier Design Helps Solve T

The Louisville & Nashville was confronted with a difficult problem when it became necessary to replace the timber-pile piers of its multiple-span, through-girder bridge across the West Pascagoula river. After careful study it was decided to construct new piers at locations midway between the old piers and to float the existing girder spans into position on them. An important element in the plan adopted was the design of the new piers, which consist of concrete caps supported on composite steel-pipe and concrete piles so located that they could be driven in the clear of the spans without any conflict with train movements.



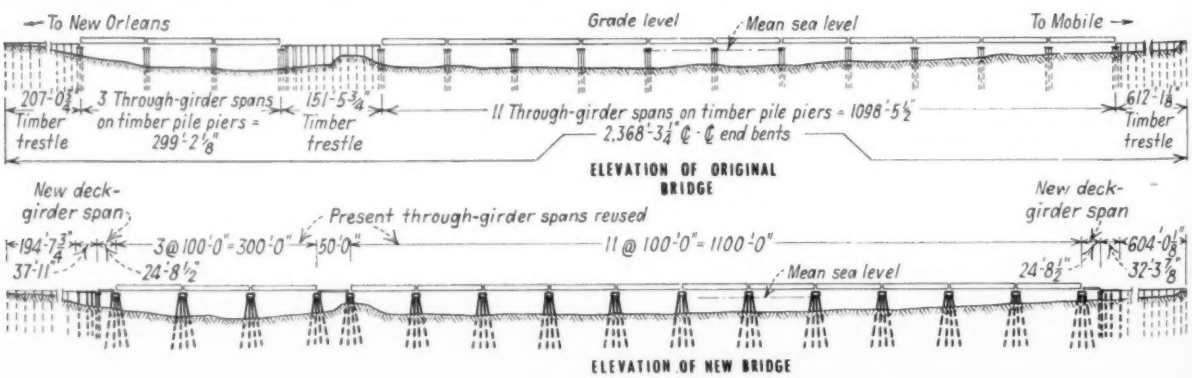
BRIDGE piers consisting of groups of composite steel-pipe and concrete piles capped with concrete beams were used effectively in a recent bridge reconstruction project on the Louisville & Nashville. In this undertaking, involving a multiple-span through-girder bridge, the new piers were reconstructed midway between the old ones on the same alinement, and the existing girder spans were floated into position on them on barges. By arranging the piles in each pier in such a manner that they could be driven outside the limits of the exisiting structure, it was possible to avoid any conflict between train movements and the work of driving the piles, thereby permitting the latter work to proceed without interruption.

The bridge involved in this project is located near Gautier, Miss., about 40 mi. west of Mobile, Ala., where it carries the single-track line of the Mobile-New Orleans subdivision across the West Pascagoula river. The bridge is located about a half mile inland from the Gulf of Mexico, where the river is approximately ½ mi. wide, but since it is not classified as a navigable stream, no provision for a movable span is necessary. The structure was built between 1901 and 1904. Beginning at the east, or Mobile, end it consisted of a 612-ft. open-deck timber-trestle approach, eleven 97-ft. through-girder spans on timber-pile piers, another 150-ft. trestle, then three more through-girder spans on pile piers, and, at the west end, a 207-ft. timber-trestle approach. All timbers and piles were treated with creosote.

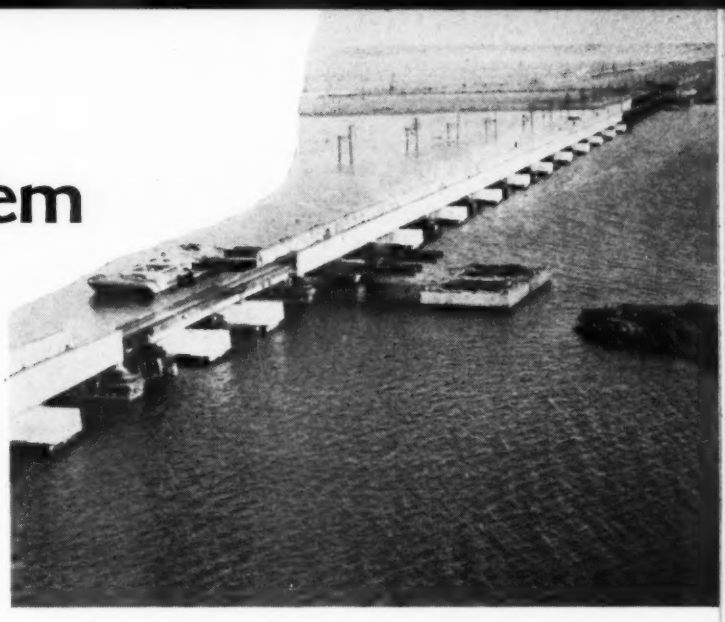
Piling Under Attack by Teredo

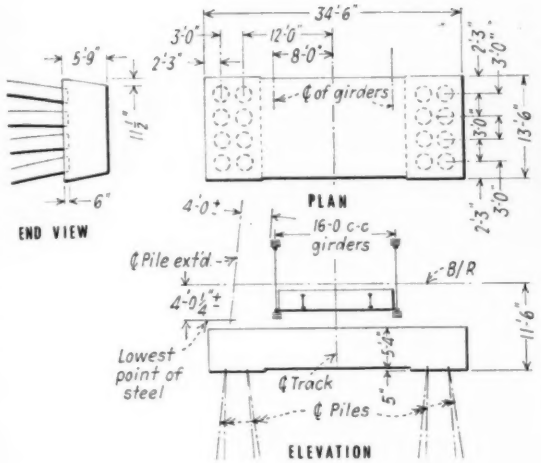
The piling in this structure was continually under attack by teredo, making necessary annual inspections by a diver and frequent replacement of damaged piles. In the case of the pile piers, already loaded to the maximum safe limit, replacement of piles was difficult, expensive and unsatisfactory. In the spring of 1944 the railroad officers decided that further adequate repairs to the timber pile piers were impracticable, and that they should be either redesigned and completely rebuilt, or replaced by different construction. The existing through-girder spans were in good condition and considered adequate for all motive

Left—As shown here the design of the new piers permitted the piles to be driven in the clear of the bridge spans. Below—Elevations of the West Pascagoula River bridge before and after the reconstruction of the substructure



This Bridge Problem





Above — Looking east across the bridge as preparations were being made to shift the first span. Left — Drawing showing details of the new piers

power contemplated in the forseeable future.

In making studies of this problem, considerable thought was given the fact that the structure is located in a region subject to violent tropical hurricanes. While no great damage to this bridge had occurred since its construction in 1903, nearby crossings of other waterways had been severely damaged during that period. Serious consideration was given, therefore, to the advisability of replacing the substructure with one designed to resist damage by hurricanes. Furthermore, it was desirable from an operating standpoint and for reasons of economy to retain the bridge on the existing alinement—a three-mile tangent. This would permit utilization of the existing stabilized approach embankments which extend through marshy country. It was realized, of course, that such reconstruction by conventional methods would require a temporary trestle to carry traffic during construction. Such a trestle would be expensive and subject to the hazards of possible storms. In addition procurement of the long timber piles required for a trestle, within a reasonable time, was extremely doubtful.

To further its study of the problem, the Louisville & Nashville requested Modjeski and Masters, consulting engineers, to make a report on the existing structure and to make recommendations and estimates for a new structure. The report of this firm confirmed the railroad's opinion that the timber piers had reached the end of their useful life. Plans advanced by Modjeski and Masters contemplated using new through girders on concrete pile piers, or, as an alternate, truss spans on open-dredge piers. Both plans provided for using steel beams on concrete-pile bents for the approaches. Either type of structure could, of course, be constructed on the existing alinement or on a new one.

Old Spans Re-Used

All these studies led to the development by the railroad of the plan finally adopted, which permitted rail traffic to continue to use the existing structure while a new substructure was constructed on the original alinement. Briefly, this plan involved the construction of new piers, 16 in all, at locations approximately midway between the old timber piers, and the shifting of the old 97-ft. girder spans longitudinally into position onto the new piers. It was contemplated that the 150-ft. length of pile trestle in the bridge would be eliminated by shifting the girder spans on both sides toward this trestle and by inserting a new 50-ft. deck-girder span to fill the remaining gap. A 25-ft. deck girder span and an additional short trestle section were to be constructed to fill the gap at each end of the main structure created by the movement of the girder spans. The old pile trestle approaches, being in good condition, were not to be disturbed.

Prior to starting work on the project the base of rail was raised 2 ft. to a new permanent grade line. In the case of the steel spans, this was accomplished by jacking up the spans, in 8-in. lifts, in synchronization with the raise in the approach trestles, the spans finally resting on 24 in. of timber blocking between the shoes and the tops of the old piers.

Of special interest in connection with this project was the design chosen for the new piers. This design provided for driving the piles in two groups, with a reinforced concrete cap, acting as a beam, between them. As stated before, each group of piles was to be driven outside the limits of the existing bridge to avoid any conflict between train movements and the pile-driving work.

The piles in these piers are made of Armco 24-in. spiral-welded steel tubing having a wall thickness of ½ in. At the bridge site two 40-ft. sections of pipe, one having a shop-attached conical cast steel point, were welded together to form a unit about 82 ft. long. This tube was driven as a closed-end pile by a floating pile driver into an underlying sand stratum. After cut-off at the desired elevation a fully-reinforced concrete pile was cast in the pipe, the concrete for each pile being poured in one continuous operation. The longitudinal reinforcement, consisting of 1¼-in. square deformed bars, was allowed to extent above the tops of the piles to be fully developed into the pier cap. Longitudinal bonding bars of 1¼-in. square steel, also for development into the cap, were welded to the top of each pipe. This particular composite design for the piles was suggested by Modjeski and Masters, and was adopted as offering the advantages of greater strength as a column and easier handling and driving due to the relatively light weight of the pipe.

For each pier 16 piles were driven in two groups of eight piles, one group at each end of the pier. Each group of piles was arranged in two lines of four piles each, which are placed parallel to the center line of track, the spacing at cut-off elevation being 3 ft. between the center lines of the rows and 3 ft. between the center lines of adjacent piles in each row. The distance from the center line of the inside row of piles in one group to the inside row of piles in the opposite group is 24 ft. All piles were driven on batters varying from 1½ in. in 12 in. to 2 in. in 12 in. The batter arrangement is such that the points of the piles in each pier are spread outward both laterally and longitudinally in order to distribute the loads over as large an area of the bearing stratum as practicable. This arrangement also causes pairs of piles to act as "A" frames in resisting traction and lateral forces.

The pipes were driven by a floating pile driver with a single-acting hammer having a 10,000-lb. ram and an energy of 32,500 ft.-lb. Since all of the piles came to final bearing in a sand stratum, their load capacity was determined by calculation from a dynamic pile-driving formula, for which the constants representing the elastic compression of the pipe and the soil were determined by taking autographic records of the axial movement of the pile head. This determination was made, however, only for a few piles whenever there appeared to be a noticeable change in the action of the pile under the hammer.

The forms for the pier caps were supported on beams hung from the pier piles. These caps, each containing 86 cu. yd. of concrete, were each cast in one continuous pour without construction joints. The reinforcement was designed in such a manner as to permit the cap to act as a beam. Each cap is 34 ft. 6 in. long at right angles to the track, and 13 ft. 6 in. wide parallel to the track. It is 5 ft. 9 in. deep where supported on the piles, while the depth of the remainder is 5 ft., 4 in.

After completion of the new piers the work of moving the existing 97-ft. through-girder spans from the old piers to the new ones was begun. There were 14 of these spans to be moved parallel to the track a distance of 50 ft. Although the substructure work was done by a contractor, the railroad decided to move the spans with its own forces in order that this work could be coordinated more closely with train movements. A train schedule was arranged to allow a three or four-hour period during daylight to move the spans.

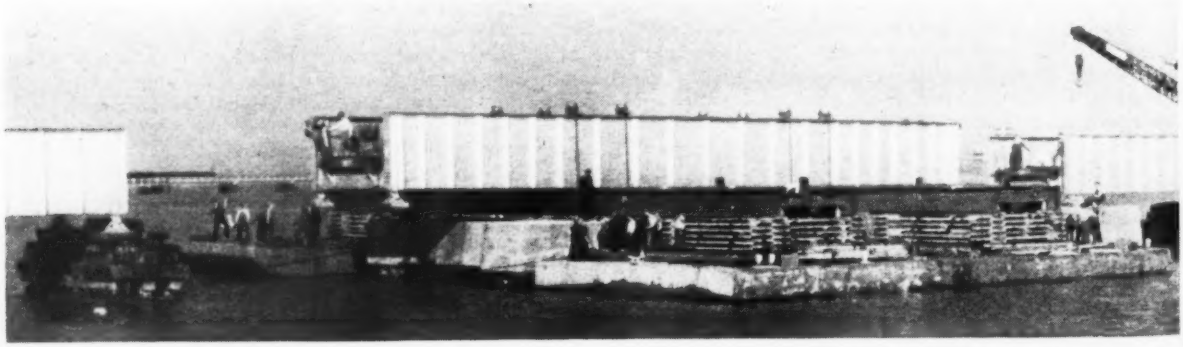
How the Spans Were Moved

After studying several schemes for moving the spans, it was decided to do this with the aid of barges. When preparing to move a span a barge was placed on each side of it and parallel to the track. Four 36-in. steel beams were placed between the barges transversely below the girders. These four beams were fabricated into two units, each unit consisting of two beams spaced 12 ft. 1½ in. between centers and tied together with a complete lateral system. The two units, 92 ft. long overall, were spaced 36 ft. 4½ in. between centers on each barge. The barges themselves were spaced 72 ft. center to center. By means of jacks and blocks between the beams and the barges, the weight of the girders, complete with shoes, deck and rails (amounting to 120 tons), was transferred from the piers to the barges and the span was then jacked up sufficiently to permit the supporting beams to clear the old piers as the barges and their load were moved forward.

Both barges were of all-welded steel construction, completely decked over, one being 100 ft. by 26 ft. and the other 75 ft. by 34 ft. To protect them from concentrated loading while carrying the weight of the girders, additional distributing beams were arranged on the deck so that the loads were supported at 12 predetermined points on each barge, these points being the intersections of transverse and longitudinal stiffening trusses inside the hull. While they were being loaded the barges were anchored to pile dolphins, or to concrete block anchors located upstream, and after being loaded, they were pulled forward to the new location of the span by a line from a locomotive crane operating on the track. The span was then lowered into position on the new piers. The moving of each span caused a gap about 50 ft. long to be created in the bridge, which was filled by a temporary girder span to permit traffic to be resumed until the next span-moving operation. In shifting the spans the east group of 11 spans was moved first. These spans were moved in succession beginning with the west span. The west group of these spans were then moved in succession beginning with the most easterly span.

The sixteen new piers were constructed under contract by the Maxon Construction Company, Dayton, Ohio. All other work was done by the railroad. Pile driving was begun in April, 1947, and the entire substructure was completed in November, 1947. The work of moving the spans was started on January 6, 1948, and completed on February 18, 1948. Between February 6 and February 15, inclusive, no spans were moved because of heavy rail traffic due to the Mardi Gras celebration at New Orleans.

All the work was carried out under the general direction of C. H. Blackman, chief engineer, Louisville & Nashville, with the design and execution of the work being under the supervision of C. K. Bruce, associate bridge engineer. R. B. Lindsey was resident engineer until September 1, at which time, having been promoted to assistant division engineer, he was succeeded as resident engineer by Major Claude Johnston. W. R. Pierson was general superintendent at the site for the Maxon Company.



A span being floated into position on the new piers. Note that the pulling power is being provided by a locomotive crane

How to Get Better Concrete

No. III of a Series

Proportioning the Mix

By A. J. BOASE
Manager, Structural Bureau
Portland Cement Association

Illustrating stiff, medium and wet mixtures of concrete

In this installment Mr. Boase explains, step by step, how concrete mixes are designed. After a discussion of how to select the water-cement ratio he shows how the amount of aggregate and the proportion of fine and coarse aggregate are determined. Other subjects discussed include variations in mixes due to changes in slump, what allowances to make for free water in the aggregates, the necessity for obtaining plastic, workable mixes, and the nature of the adverse results obtained with mixes that are improperly proportioned.

FOR MANY years concrete was specified by arbitrary mixes, that is, so many volumes of sand and so many volumes of coarse aggregate per sack of cement. No mention was made as to the amount of water. Now, everyone concerned with concrete knows that such a specification is not adequate if we are to get the best results. Actually, the water requirement may vary over a wide range for a given arbitrary mix.

It has been pointed out in the previous articles of this series that the water requirement is affected by grading, size and shape of aggregates and by consistency of concrete. Then, too, when sand is measured by volume, the actual amount of dry sand measured will vary considerably due to the variable amount of bulking caused by the moisture. Small wonder that unpredictable results were obtained with the arbitrary mix.

Shortly after it became fully evident that the durability, potential strength and other properties of concrete were largely dependent on the water content, a number of methods of proportioning based on this relationship were developed. Generally these were awkward to use and involved some rather lengthy calculations. Then the mix finally obtained had to be considered as a trial mix as it was almost certain that adjustments would be necessary when the mix was actually tried in the field. In some instances the results were very unsatisfactory because the calculated mix was used without making the necessary adjustments in the field after trying it out. These experiences led to the more direct and comparatively simple method of making trial batches.

Many of those who read these pages have had experiences that will guide them in making such trials, but with the thought that others would like to have some idea as to where to start, the following discussion is included to assist them. As a starting point, the mix may be based on published experimental and field data and on the recommendations of men who have had considerable field experience. It should be emphasized, however, that adjustments will be necessary in the field; but these will be no more than those involved in the earlier methods and the calculations will be reduced to a minimum.

As the first step in designing the mix one must determine what water-cement ratio to use. Must the concrete be watertight? Will the concrete be exposed to the weather? If so, how severe are the weather conditions? How heavy are the concrete members? What strength concrete is required for the design? Answers to these questions will influence the selection of a water-cement ratio. Table 1 gives recommended maximum water-cement ratios for a wide range of conditions. It is based on many tests and on experience, and provides an excellent guide for selecting the maximum water content so far as water-tightness or resistance to weathering is concerned.

Having made this selection, the next step is to find the water-cement ratio necessary to develop the desired strength. On large, important structures it is desirable to determine the water content-strength relation by making preliminary tests with the materials it is intended to use on the job. In lieu of such tests, average values based on accumulated field and laboratory data may be used.

Average values for normal portland cement concrete of plastic consistency, cured moist at 70 deg. F. until tested, were given in Fig. 3 of the first article of this series and the chart is repeated here for convenient reference. Of course, one cannot expect to get the most economical results when using such average values, but this objection is not too serious. At least we can be reasonably sure of having the necessary strength.

Table 1—Net Water-Cement Ratios for Various Types of Construction and Exposure Conditions*

Type or location of structure	Severe or moderate climate, wide range of temperature, rain, and long freezing spells or frequent freezing and thawing					Mild climate, rain or semiarid; rarely snow or frost				
	Thin sections, gal. per sack		Moderate section e, gal. per sack		Heavy and mass sections, gal. per sack	Thin sections, gal. per sack		Moderate sections, gal. per sack		Heavy and mass sections, gal. per sack
	Reinf.	Plain	Reinf.	Plain		Reinf.	Plai n	Reinf.	Plain	
A. At the water line in hydraulic or waterfront structures or portions of such structures where complete saturation or intermittent saturation is possible, but not where the structure is continuously submerged:										
In sea water	5	5½	5½	6	6	5	5½	5½	6	6
In fresh water	5½	6	6	6½	6½	5½	6	6	6½	6½
B. Portions of hydraulic or waterfront structures some distance from the water line, but subject to frequent wetting:										
By sea water	5½	6	6	6	6	5½	6½	6½	7	7
By fresh water	6	6½	6½	6½	6½	6	7	7	7½	7½
C. Ordinary exposed structures, buildings and portions of bridges not coming under above groups	6	6½	6½	7	7	6	7	7	7½	7½
D. Complete continuous submergence:										
In sea water	6	6½	6½	7	7	6	6½	6½	7	7
In fresh water	6½	7	7	7½	7½	6½	7	7	7½	7½
E. Concrete deposited through water	**	**	5½	5½	5½	**	**	5½	5½	5½
F. Pavement slabs directly on ground:										
Wearing slabs	5½	6	**	**	**	6	6½	**	**	**
Base slabs	6½	7	**	**	**	7	7½	**	**	**

G. Special case: For concrete not exposed to the weather, such as interiors of buildings and portions of structures entirely below ground, no exposure hazard is involved, and the water-cement ratio should be selected on the basis of the strength and workability requirements.

*Adapted from Table 1 of the 1940 Joint Committee "Report on Recommended Practice and Standard Specifications for Concrete and Reinforced Concrete."

**These sections not practicable for the purpose indicated.

Now, two water-cement ratios have been selected, one for watertightness or durability, and the other for strength. The lower of the two values should be used. That may give higher strengths than necessary but the concrete will have the required durability. On most exposed work, concrete designed for durability will have more than sufficient strength.

Now that we know how much water to use the next step is to determine how much aggregate and what proportions of fine and coarse to use. Here we can rely pretty much on information that has been gathered by a committee of the American Concrete Institute, which is published in the Institute's Journal for June, 1945. This information includes the approximate total amount of water required per cubic yard of concrete for different conditions and the recommended fine to coarse aggregate proportions for good workability. From this information approximate mixes can be calculated. This has been done for average aggregates in the four most popular sizes and for the range of water-cement ratios ordinarily used. These mixes are given in Table 2. They should be considered only as trial mixes and it should be realized that adjustments may be necessary in the field to give a mixture having the proper workability for the job. The extent of such adjustments is affected by the grading of aggregates, shape of particles, desired workability and other factors.

Table 2 would be expanded to many times its present size if all variables were to be taken into account, but footnotes are given to show changes that should be made for conditions which vary from those on which the table is based. The values indicated are for concrete of medium consistency (3-in. slump) and sand of medium grading. It will be noted in Column 3 of the table that the quantity of water per cubic yard of concrete for a given size and type of aggregate, and a given consistency, remains the same, regardless of the water-cement ratio. This is true for the range of water-cement ratios which are ordinarily used.

As shown in the footnotes to the table, for other consistencies the water per cubic yard of concrete increases or decreases with increases or decreases in slump at the rate of approximately 1 gal. per cubic yard for each 1-in. change in slump. Thus, for 1-in. rounded aggregate the table shows 36 gal. of water per cubic yard of concrete having 3-in. slump.

If the slump is to be increased to 5 in., the water required will be 36+2=38 gal. This quantity, divided

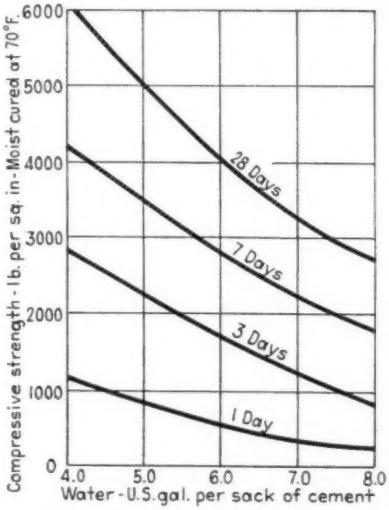
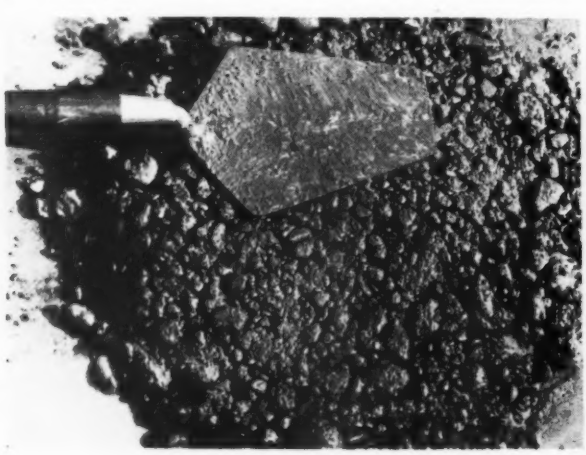


Fig. 3—Age-compressive strength relation, concrete made with normal portland cement



by the water-cement ratio, will give the quantity of cement required. Thus, for 6 gal. of water per sack of cement the cement factor will be 38 ÷ 6 = 6.33 sacks per cubic yard of concrete or ⅓ sack more than indicated in the table. This additional cement is required with the wetter consistency to produce concrete having the same strength. Since the water content and cement content both are increased, less aggregate will be used. Making this adjustment in the amount of coarse aggregate and using the same amount of fine aggregate will give about the same workability. In this example when the slump is to be increased from 3 in. to 5 in. the coarse aggregate will be decreased by 2 × 20 = 40 lb. per sack of cement.

Table 2—Suggested Trial Mixes for Concrete of Medium Consistency (3-In. Slump)*

Max. size of coarse aggregate in.	Water gal. per sack of cement	Water gal. per cu yd. of concrete	Cement sacks per cu. yd. of concrete	Sand % of total	Sand lb. per sack of cement	Coarse agg. lb. per sack of cement
USING ROUNDED COARSE AGGREGATE						
¾	5	37	7.4	43	180	235
1	5	36	7.2	38	165	270
1½	5	34	6.8	34	160	310
2	5	32	6.4	31	160	350
¾	6	37	6.2	45	230	280
1	6	36	6.0	40	215	320
1½	6	34	5.7	36	210	360
2	6	32	5.3	33	210	425
¾	7	37	5.3	47	285	325
1	7	36	5.1	42	270	370
1½	7	34	4.9	38	260	420
2	7	32	4.6	35	260	480
¾	8	37	4.6	49	350	365
1	8	36	4.5	44	325	415
1½	8	34	4.3	40	320	465
2	8	32	4.0	37	320	540
USING ANGULAR COARSE AGGREGATE						
¾	5	40	8.0	48	175	190
1	5	39	7.8	43	165	220
1½	5	37	7.4	39	160	250
2	5	35	7.0	36	160	290
¾	6	40	6.7	50	230	230
1	6	39	6.5	45	215	260
1½	6	37	6.2	41	210	300
2	6	35	5.8	38	210	345
¾	7	40	5.7	52	285	265
1	7	39	5.6	47	265	300
1½	7	37	5.3	43	260	350
2	7	35	5.0	40	260	400
¾	8	40	5.0	54	345	290
1	8	39	4.9	49	320	335
1½	8	37	4.6	45	320	395
2	8	35	4.4	42	320	440

*For other gradings of sand and other consistencies, the mixes in this table should be modified as follows:

For very fine sand reduce the amount of sand about 10 lb. per sack of cement and increase the coarse aggregate about 10 lb. For very coarse sand increase the amount of sand about 10 lb. per sack of cement and reduce the coarse aggregate about 10 lb.

For each decrease of 1 in. in slump, increase the coarse aggregate about 20 lb. per sack of cement. The water will be decreased about 1 gal. per cu. yd. of concrete and the cement will be decreased about 0.10 sack for 8 gal. concrete to 0.20 sack for 5 gal. concrete.

For each increase of 1 in. in slump, decrease the coarse aggregate about 20 lb. per sack of cement. The water will be increased about 1 gal. per cu. yd. of concrete and the cement will be increased about 0.10 sack for 8 gal. concrete to 0.20 sack for 5 gal. concrete.

Too harsh and wet a mix, combined with flowing over long distances within the forms, resulted in segregation, honeycomb and laitance in this deteriorating retaining wall

For stiffer consistencies the adjustments in the mixes shown in Table 2 will be in the opposite direction. Since the water content per cubic yard of concrete will be decreased, the cement factor will be decreased and the amount of coarse aggregate will be increased.

The grading of the sand has an influence on the quantity that should be used. If the sand is very fine, less sand and more coarse aggregate than shown in Table 2 should be used, and if the sand is very coarse, more sand and less coarse aggregate should be used. Most sands furnished by commercial producers are of medium grading, on which Table 2 is based.

The fact that aggregates are moist when used in the field complicates matters somewhat. Here we are concerned mostly with the sand, as ordinarily the coarse aggregate carries little free moisture. The sand, however, may have from ¼ to 1 gal. of free water per 100 lb. of sand. This means that as much as 3 gal. of free water may be introduced into the mixture with the sand, and this, of course, must be considered as part of the mixing water. While usually the free water is less than this maximum amount, it is nearly always enough that a correction for it should be made. Failure to do so will result in the actual water-cement ratio being higher than intended—a condition that is responsible for the lack of durability observed in some structures.

Wherever possible the amount of moisture in both fine and coarse aggregates should be determined by test. This is not difficult to do. The simplest method is to weigh a sample of the damp material, dry it, and then weigh it again. Drying may be continued until only the surface moisture is driven off or until the sample is bone dry. In the latter case, correction may be made for absorbed moisture, which is usually about one per cent for sands, gravels and crushed stones. Thus, if a sample of the damp sand weighs 35.3 oz. and the sample weighs 33.3 oz. when bone dry, the total moisture will be 2.0 oz., or 6 per cent. Subtracting the absorption of 1 per cent, the free moisture, considered as part of the mixing water, will be 5 per cent.

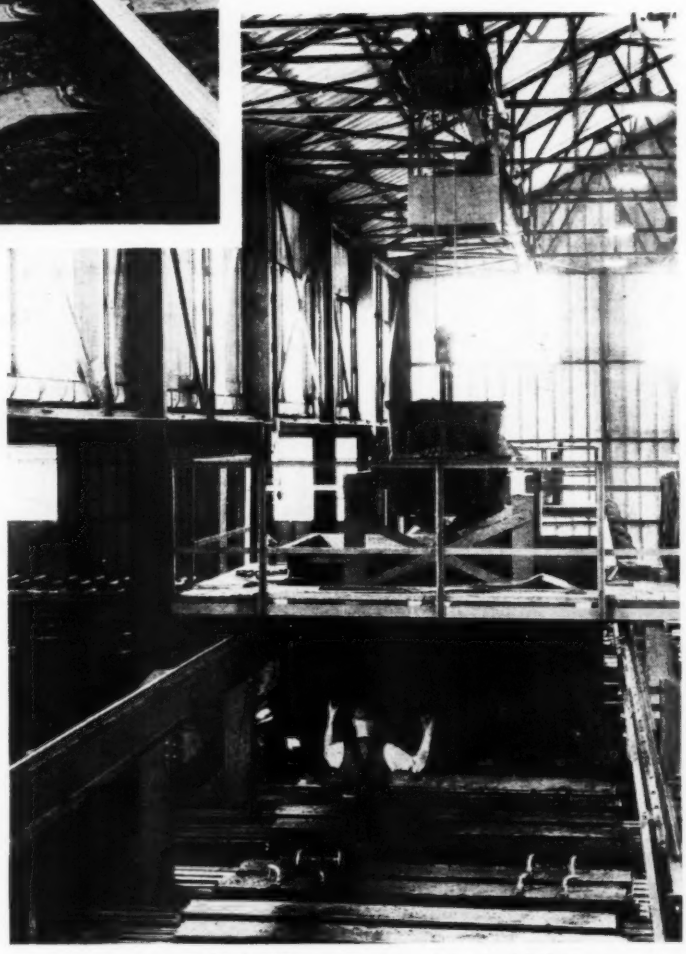
Two corrections should be made to allow for this moisture—one in weighing the sand and the other in measuring the water. Suppose our trial mix calls for 225 lb. surface-dry sand. For each 100 lb. called for it will be necessary to weigh out 105 lb. because there is 5 lb. of free moisture per 100 lb. of surface-dry sand. Then it will be necessary to set the scale at 236 lb. to give us 225 lb. of surface-dry sand.

(*Continued on page 609*)

Far left—A mixture containing too little mortar. Middle left—With a correct amount of mortar all spaces between coarse aggregate particles are completely filled. Left—An excess of mortar gives poor economy and the concrete will have a shrinkage factor which is high

British Test p

Left—A stretch of track showing bullhead rail laid on concrete ties



The molds are filled with concrete from this movable hopper

Faced with a serious shortage of home-grown timber for use as crossties, the railways in Britain have been searching for many years for a suitable alternative. During the recent war an increase in this shortage made it necessary to make extensive use of prestressed reinforced concrete ties, which have shown attractive possibilities and are now being manufactured on a mass-production basis. This article describes the manufacture of the prestressed ties and discusses the initial results being obtained from their use.

FOR a number of years prior to the recent war, practically all of the crossties used by the British railways were imported for the reason that home-grown timber was either unsuitable for treatment or the small quantity of suitable timber that was available was too small in section to be converted into ties. Most of the ties came from the Baltic countries and were, for the most part, of Baltic redwood, but a large number of Douglas fir ties were imported from Canada and the United States.

During the war little or no timber was imported from the Baltic area and the same situation prevailed with regard to imports from North America. Accordingly, the British railways were faced with the necessity of providing an alternative to replace their timber ties as renewals became necessary. In 1941 these roads adopted a set of specifications for reinforced concrete ties, which not only set forth standards with regard to materials and tests, but also laid down a minimum bending moment on the critical section in the ties.

A number of companies submitted designs for ties based on these standards, one of which—submitted by the Prestressed Concrete Company—involved the relatively new principle of prestressing the reinforcing material in the tie while the concrete is being cured. After curing, the tension is released and the resulting contraction of the reinforcing sets up a permanent compressive stress in the concrete. The compression insures that no hair cracks will develop under the designed load conditions and the factor of safety allowed.

As a means of determining the relative merits of the various designs of concrete ties submitted for consideration, the London, Midland & Scottish Railway (now the London Midland region of the British Railways) started to carry out a series of practical service tests. A length of main track over which trains normally passed at a speed of about 70 m.p.h. was selected for the test and consecutive 60-ft. stretches were laid with concrete ties of each design.

The primary object of this investigation was to measure the stresses imposed on the ties by the passage of trains, the reaction between the under side of the chair* and the tie, and the

*The "bullhead" rail section is widely used in England and the European countries. This rail has a rounded base and is held in position on this base by cast-iron supports, known as chairs, which fit snugly around the base and are bolted to the ties or fastened to them with screw spikes. Increasing use is now being made of "flat bottom," or T-section rail, supported on cast-iron sole plates.

Prestressed Concrete Crossties

By R. L. M'ILMOYLE,
Assistant Engineer of Structures,
London Midland Region, British Railways
London, England

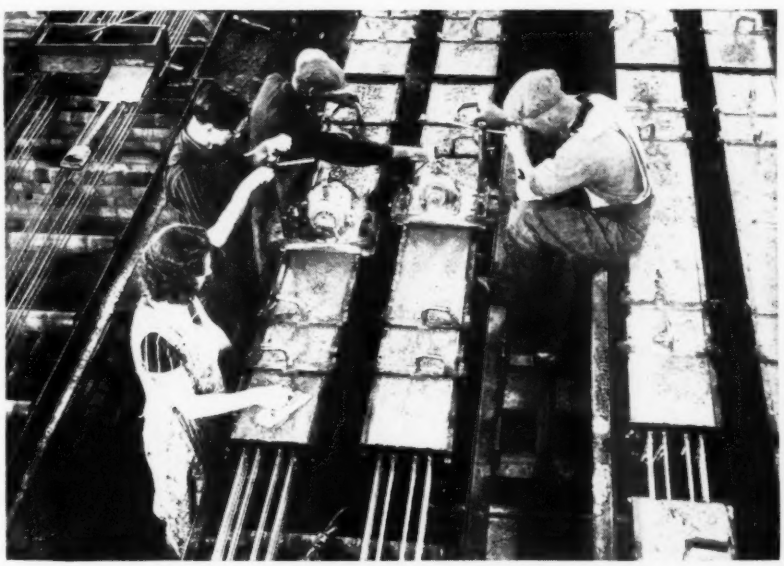
reaction between the tie and the ballast. The results of these tests led to a revision of the original specifications, in which the design loads and permissible stresses were more completely dealt with, and which included special clauses relating to the design of prestressed ties which, in the tests, had shown themselves to be superior in performance to any of the other types of concrete ties.

The end of the war did not bring an end to the problems of the British railways with respect to securing of timber for crossties. On the contrary, the situation has become even more acute, with the result that the government has decided that the shortage can be met only by the large-scale manufacture of ties of the prestressed types. The patent rights for the manufacture of the prestressed ties have been acquired by Dow-Mac, Ltd., and this company has built a factory capable of producing 4,000 of these ties at one time. In addition, the government has made arrangements for certain ordnance depots to take over the manufacture of additional prestressed ties of the Dow-Mac design.

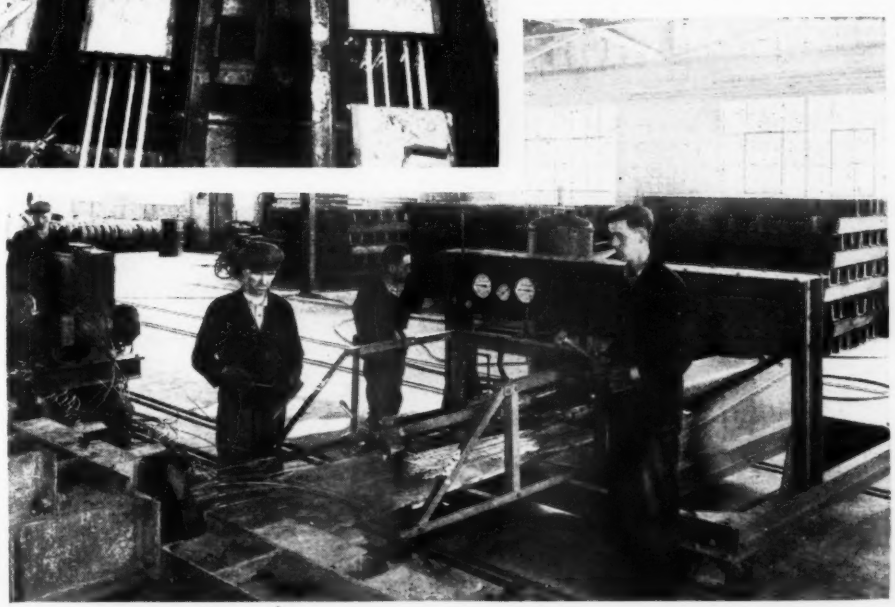
The production of the concrete ties at the Dow-Mac plant is fully mechanized but is closely controlled so that the ties are uniform with respect to the concrete mixture and the degree of prestressing.

The factory has two manufacturing areas, each 140 ft. by 500 ft., allowing for a total of 40 production lines, each accommodating 100 standard main-line ties.

Each of the production lines is a waist-high roller-conveyor, sufficiently long to accommodate two lines of 50 ties each, with mass concrete abutments at each end. The abutments support heavy steel structures to which the reinforcing wires are anchored during the operation of prestressing them.



Above—When the ties reach their final position in the production line, they are trowelled and then vibrated to insure a good bond between the concrete and the reinforcing



Right—Tension is applied to two wires at a time by this hydraulic cylinder, which is equipped with an automatic cut-out. When the proper tension is applied, the wires are secured in the holes in the anchor plate by means of wedges

Prestressing

The molds, or forms, used in the manufacture of the ties consist of open steel troughs with removable end plates, the plates being punched with holes to accommodate a series of reinforcing wires and secured to the ends of the troughs or molds by means of wing nuts.

Steel wire of 0.2 in. diameter, with an ultimate tensile strength of 100 tons per sq. in., is used for reinforcing. The wire reels are carried on a truck moving on a transverse track at one end of the production area adjacent to one line of abutments. The wires are drawn off under semi-tension and, in the process, pass through a scrubbing box in which they are cleaned with carborundum. They are then threaded through the proper holes in all of the 50 pairs of end plates for one production line, after which they are secured, at the advance end, by means of wedges, to a fixed anchor plate in the steelwork of the abutment at that end. The wires are then cut at the reel and the free ends are passed through a similar anchor plate at the adjacent abutment. The proper tension is then applied to the wires, one pair at a time, by a hydraulic cylinder with an automatic cut-out. The wires are then secured to the fixed anchor plate by means of wedges.

Casting the Ties

The molds are assembled at an assembly table by passing the trough section of each mold under the taut wires and securing a pair of end plates to it. Rods are inserted through clamps at the top of the molds and extend through holes in the bottoms so that properly located holes will be formed in the ties to accommodate the bolts for fastening the chairs, or sole plates.

The empty mold then moves along the conveyor to the concreting position. Here it is filled with concrete from a movable hopper traveling on an overhead runway extending across all of the production lines. The hopper is designed to discharge, at one time, all the concrete needed to fill one mold. A vibrating table is located at the concreting position in each line, thus allowing the use of a relatively stiff mix in which the water-cement ratio is 0.39, or approximately 4.5 gal. per sack of cement.

As soon as the molds are filled and vibrated they are moved along the conveyor, to their respective places in the production line. During this movement, the stretched wires move through the concrete in the molds. On reaching their final position, the concrete is troweled and the molds are given a second vibration with a portable electric vibrator to improve the consolidation of the concrete and insure a perfect bond between the concrete and the reinforcing wires. The concrete is allowed to cure for 10 to 14 days, depending upon weather conditions, during which time the tension in the wires is maintained at a constant level.

Tension Released

When the concrete has cured, the wires are cut at one end of each row, thus releasing the tension between the ties, after which the removable end plates of the molds are removed and the wires are burned off flush with the concrete by an oxy-acetylene cutting torch. Removal of the tie from the mold is accomplished by turning the mold over, and lifting it off.

Costs Reduced

The method of maufacture described requires only three minutes working time per pair of ties for concreting and removing the molds. A similar period is required for the wiring process. Mass-production methods have reduced the manufacturing costs approximately 88 per cent in six years.

The test prestressed ties installed in the main line of the London, Midland & Scottish have now been in service for five years, during which time they have been subjected to traffic which is estimated to be equivalent to approximately 12 years' service on ordinary main-line routes. The prestressed tie has been relatively satisfactory under slow-moving traffic. However, in spite of its success in the main-line tests, it is too soon to say that it will have an economic life under these conditions. New designs are now being prepared which are expected to give even better performance, but these have not, as yet, come into regular production.

Prestressed concrete ties, manufactured in a manner similar to that described in this article, are also being tested at the present time on the railways in Ireland, Egypt, India, New Zealand, South Africa, the Sudan and Holland.

Another view of prestressed ties in track. In this case, T-section rails are secured to the ties through cast-iron sole plates

Better Concrete

(*Continued from page 605*)

The free moisture will be 236-225, or 11 lb. Since a gallon of water weighs 8.33 lb., this will be 11÷8.33=1.32 gal., which must be subtracted from the water to be added at the mixer. If a total of 6 gal. is called for, the amount to be added will be 6.00—1.32=4.68 gal. Similar corrections should be made for the coarse aggregate if this contains any appreciable amount of free moisture.

Other Considerations

It is important that the mix be proportioned to give a plastic, workable concrete. These are somewhat relative terms; concrete that is workable for one type of construction may not be workable for another. Stiffer, harsher mixes can be used in large, massive members than in smaller members, but if this is carried too far honeycombing and stone pockets may occur. Stone pockets are particularly likely to develop at the bottom of each lift under these conditions. Honeycombing and stone pockets permit the entry of water, thereby causing deterioration upon freezing and thawing.

A plastic, workable mixture means that it should be cohesive, that is, a mixture that will not permit separation of the mortar from the coarse aggregate or separation of the water from the mortar. Sometimes an excessive amount of water in concrete that is much wetter than necessary is used to facilitate placing a mixture that has poor workability. Such a mixture lacks cohesiveness, results in honeycomb and stone pockets, and also in areas of mortar which have separated from the coarse aggregates. This mortar has high water content and little resistance to weathering.

Poor Results Illustrated

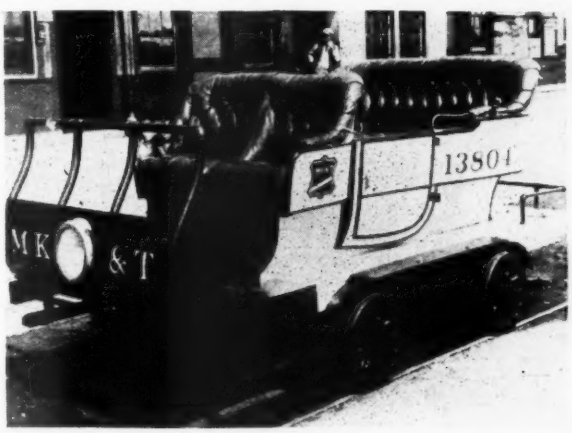
Such was the case in the retaining wall shown in one of the accompanying illustrations. Concrete was dumped in the middle of each 50-ft. section of wall and allowed to flow to the ends. The mortar was washed from the coarse aggregate and gathered at the construction joints. The mortar, being extremely porous, eventually weathered away as moisture percolated through from the fill, and the wonder is that the wall served for many years before it was necessary to repair it. Honeycombing was so pronounced in some areas that handfuls of coarse aggregate particles could be dislodged with no mortar or fine material surrounding them. All this could have been avoided by using a cohesive, workable mix and dumping the concrete at uniformly distributed spots along the length of each wall section.

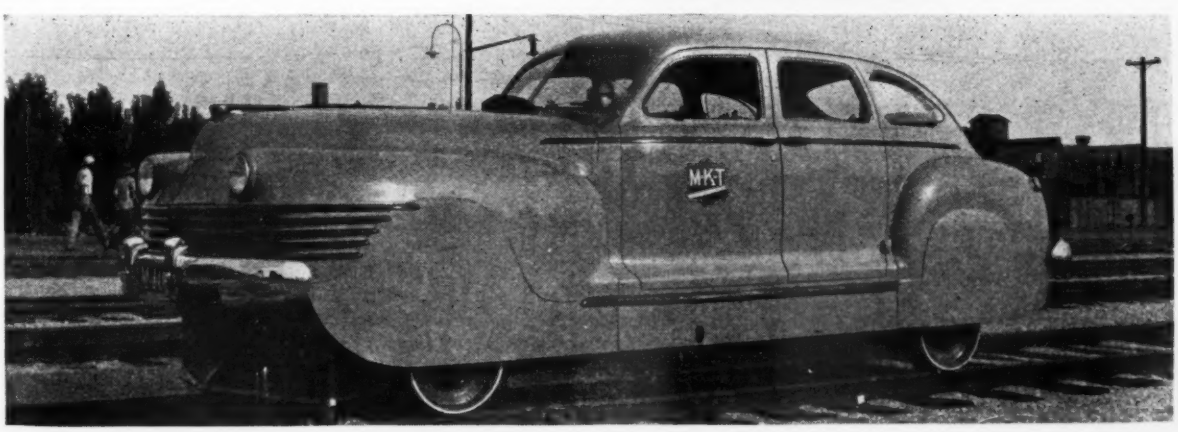
Sandstreaking

Another defect sometimes occurring on concrete surfaces because of improper proportioning is sandstreaking, caused by the sudden release of water along the forms. As this water rises along the form surface it washes the cement from the sand particles, leaving streaks of exposed sand. Their formation is the result of insufficient fine material in the mixture for the rate at which the concrete is placed. A slightly richer mix, with correspondingly less water, somewhat more sand or the addition of a small amount of fine sand passing the 50 and 100-mesh sieves, will usually overcome this difficulty. In some instances it is practicable to place the concrete at a slower rate without losing economy, and this will help in preventing sandstreaking.

Yesterday and Today in Official Inspection Cars

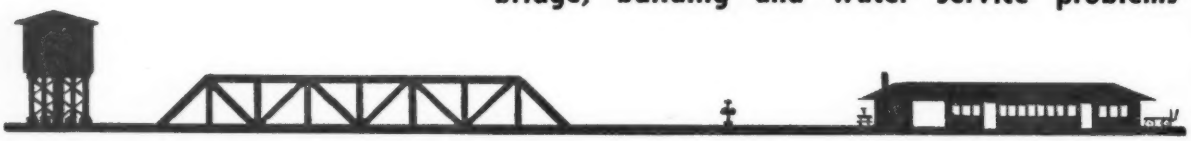
THESE photographs illustrate the evolution that has taken place in official inspection cars on the Missouri-Kansas-Texas. At the right is a likeness of the first car of this type ever used on the Katy. Built in 1917, it consisted of a discarded section motor car on which was mounted the body of a Studebaker automobile. In strong contrast is the sleek-appearing vehicle pictured below, which consisting of a modern automobile mounted on flanged wheels, is representative of the official inspection cars now in common use on the Katy. In these cars the steering wheel serves only as a special reverse lever which is connected to a gear that enables the cars, on a moment's notice, to back up with the same speed that they travel forward. Also, each car is fitted with special hydraulic jacks in order that it can be turned quickly if the necessity should arise.





WHAT'S THE ANSWER?

An open forum for maintenance men on track, bridge, building and water service problems



Laying Rail With Two Gangs

Where large rail-laying operations are involved, is it practicable to organize and equip two separate gangs, the second to relay the opposite rail a mile or so behind the first gang? What are the advantages and disadvantages of such a set-up?

Not a Practical Plan

By H. R. CLARKE
Chief Engineer, Chicago, Burlington & Quincy, Chicago

To handle a rail-laying operation as this question suggests, it would be necessary that rail and fastenings be available so that all material could be unloaded and distributed well in advance. This has not been possible for the past several years, except by permitting material which has been received to lie unused for a longer period than is considered desirable. Further, to make such an organization feasible, it would be necessary that the rail relay locations be of some length.

While under the above conditions it would be possible to organize two separate gangs, one following the other, I doubt if it is a practicable thing to do. It would mean the concentration of a substantial force and a great deal of equipment in a limited area. Any delay to one of the gangs, particularly that in front, due to the failure of mechanical equipment, the lack of sufficient men, or other unavoidable conditions which from time to time delay the progress of a gang, would probably result in a similar slowing up of the second gang. In a normal operation this might not be necessary.

Good workmanship is of great importance in a rail relay operation, and where the entire job is done by one gang and under the same supervision, individual performance can be more easily checked and policed, and responsibility for poor workmanship more easily placed.

A well organized and fully mechanized rail gang can lay rail at a rate which greatly reduces any advantage there might be in the use of two gangs. There is some loss of time in moving the equipment back to bring up the rail on the other side, but where this is handled as it should be, the operation is done generally outside of the assigned working hours, with little, if any, delay to the gang as a whole, or to the progress of the work, and merely at the expense of a little overtime for a few men.

From time to time an organization such as suggested above has been proposed and discussed, but so far as I know, no serious attempt has been made to place such a plan in operation. This would seem to indicate that the possibility has not been overlooked, but that practical track men have agreed that the plan is not a practicable one.

Two Gangs More Economical

By ROYCE KERSHAW
General Manager, Royce Kershaw Co., Inc., Montgomery, Ala.

From my observation and study of large rail gangs throughout the mid-central and eastern United States, and from my own experience in relaying approximately 200 mi. of rail in two years, it is my definite conclusion that more rail will be laid per man hour with two rail gangs of 54 men each than with one 108-man gang working on one rail. The first gang would lay the rail on the outside of all curves, followed by the second gang working one mile behind the first, or sufficiently far enough behind it so that the first line of rail laid would be settled on the ties by traffic before the second line is laid. Since these two 54-man gangs will complete 1½ to 2 mi. daily, it is assumed that at least 50 mi. of work should be planned in order to realize the maximum economies. The

Send your answers to any of the questions to the What's the Answer Editor. He will welcome also any questions you wish to have discussed.

To Be Answered In the August Issue

1. *Where new rail is laid and it is impracticable to have the new locations of the insulated joints fall within the limits of present bootleg connections, what is the most effective means of relocating the bootlegs with the least disturbance to signal wires and to the track structure? Explain.*
2. *What effective methods can be used in the design and construction of brick-masonry walls to prevent the infiltration of moisture? To waterproof existing brick walls?*
3. *How important is it to make preliminary subsoil investigations in unstable roadbed to determine the character and extent of the corrective measures to be taken? How should these investigations be made and by whom?*
4. *How serious is the plate-cutting of bridge ties? Where this is a problem, how can it be overcome or minimized?*
5. *On what items should the inspection and maintenance of track scales and scale pits be focused? Should such be on a regular schedule? Why? By whom?*
6. *When a water tank has settled out of plumb, what is the best method of correcting the condition? Does the type and capacity of the tank make any difference?*
7. *What are the most practicable and effective methods of controlling weed growth about wood preservation plants and timber storage areas? Explain. Are special precautions necessary?*
8. *How can camp cars be effectively protected against the origin and spread of fire? Explain. Who shares in this responsibility?*

determining factor, of course, is the number of rails laid per man-hour or man-day over a period of thirty working days.

Time studies made of various large rail gangs of 110 to 120 men show that considerable time is lost where the men do work on alternate rails or ties. A specific example is the spiking of the rail. A large rail gang laying one rail uses four to six air hammers behind the gage, which means that alternate ties have to be spiked. Naturally the time consumed in moving over two ties is much greater than the time consumed moving from one tie to the next. The maximum use of equipment is also not realized because this equipment works on alternate ties or alternate rails. This refers particularly to spike pullers, wrenching machines and pneumatic spike drivers.

On normal operations the machines used in relay gangs will accomplish the work at the rate of one rail per minute. A bolting machine will tighten or loosen the bolts in one joint per minute; a spike puller will pull all spikes, except the joint spikes, in about two rails every three minutes; a cribbing machine will remove the ballast ahead of the adzers at the rate of one rail per minute; two adzing machines will adze the ties at the rate of one rail per minute; two gaging crews will gage one rail per minute; and two air hammers will spike the track solid behind the gagers at the rate of one rail per minute. This production is based on each machine working at every joint or at every tie, and not at alternate ties or rails. Innumerable time studies and records show that this rate of production—three to five rails per man-day—can be maintained throughout the working day while the track is clear. No time is lost in moving from tie to tie.

The gang following on the other rail should also maintain the same rate of production. By using one gang on each rail, the equipment can be set off directly where it will be placed in operation the next morning. This means a saving of about thirty minutes to one hour with each gang, or approximately seventy-five man-hours daily that would be lost in moving the equipment back to start the other rail. As a result, approximately 50 to 100 more rails can be laid in one day. In whatever way it is figured, there is a definite saving in the use of two gangs of approximately 54 men each, rather than one large gang of 110 men on one rail.

From actual reports of a test made on a 33-mi. relay operation, the last five miles were laid on one side and then the equipment was simply turned around and started back on the other rail. This meant that no time was lost in moving the equipment back to lay the other rail. With a 54-man gang the average production per day was increased 55 rails due directly to having the equipment in place ready to start work the following morning.

One Gang Is Better

By F. M. Harris
Roadmaster, Missouri Pacific, Marianna, Ark.

It is not likely that it would ever be practicable in large rail-laying operations to organize and equip two gangs, the second to lay the opposite rail a mile or so behind the first gang. If the rail being released is of the same weight, height and length as the rail being laid, it may be feasible to use two gangs. The only advantage, however, would be the time saved on the move-back to the opposite side. It would never be practicable, nor would it be safe to use two gangs—one laying the opposite rail a mile or so behind the first gang—where the rail being laid is of different weight than the rail that is being released. Where the speed of trains is high, slow orders would have to be maintained in such cases, especially on the curves.

There is always some delay in moving gangs back to lay the opposite side, but if the gang is well organized there should be very little delay in starting to lay the opposite side. When it has been decided to move back, and while the cut-in is being made, the assistant foreman should go back to start the opposite rail, taking with him the adzing machines, the rail machine, the men who pull spikes and those who plug spike holes. When the cut-in has been made, the lead spikers, and the men who were engaged in making the joint should be sent back. Thus, by the time the rear spikers have completed spiking the lead side in full, the assistant foreman should be laying rail on the other side.

In making the switch-over moves, a motor car can be used to good advantage in hauling the men and tools. It is important, of course, that the foreman knows that his assistant foreman and lead men understand just what is to be done, or confusion and delay will result.

Renewing Ties Before Laying Rail

Under what conditions, if any, should ties be renewed before new rail is laid? What are the advantages? The disadvantages?

Depends on Tie Condition

By F. G. Campbell
Chief Engineer, Elgin, Joliet & Eastern, Joliet, Ill.

The answer to this, in my opinion, depends almost entirely upon the answer to the much discussed question as to whether track should be surfaced before or after new rail is laid. Most certainly tie renewals should be made at the time surfacing operations are carried on.

In laying continuous-welded rail, I would recommend that all surfacing work, except dressing, be done just prior to the laying of the rail. At this time all ties having a remaining service life of less than five years should be renewed. This procedure will permit the thorough solidification and stabilization of the ballast under the new continuous-welded rail before the track has to be disturbed again. It is true that some minor tamping of low spots may be required to correct surface defects which existed in the old rail. However, these will not be sufficient to disturb the new track.

Whether ties should be renewed before or after the laying of new bolted rail depends, I believe, entirely upon the condition of the ties and surface under the rail that is to be renewed. If a comparatively large number of ties are in need of renewal, I believe that it is often advisable to surface the track and renew all ties having a very limited remaining service life before the rail is renewed. This will avoid the possibility of surface bending or otherwise damaging the new rail. A disadvantage in surfacing before laying the new rail is the inability to properly space joint ties. However, this is not of particular importance if heavy rail with six-hole joint bars is to be laid.

Renew Ties When Surfacing

By William Lindsey
Yard Foreman, Chicago & Illinois Midland, Pekin, Ill.

Except at special locations, ties should generally be renewed when the track is surfaced, whether before or after new rail is laid. At such times the old ties can be removed with a minimum of digging and the new ties

will be seated on the undisturbed old bed.

In tunnels, it might be considered advantageous to renew ties and lay rail simultaneously. In other locations, such as in cuts where side clearances are small, and in yard and industrial tracks, especially those that are depressed, where similar situations exist, a lot of time and expense can be saved by installing the ties when the rail is removed for relaying.

Install Ties First

By Former Transportation Officer
U. S. Army

Generally speaking, the average condition of the ties should decide whether they should be renewed before or after rail is laid. To get the best results, new rail must be laid on generally good ties, and the track must be in good line and in good surface. If these conditions are less than the best, they should be corrected before rail is laid so that its life will be prolonged and its service will be better.

There are three main advantages of replacing old ties before new rail is laid: (1) Good ties give uniformly good support to the tie plates; (2) sound wood in good ties help the spikes to hold the rail in line; and (3) uniform gage is assured by spiking into good ties. Other advantages include the uniform settlement of tie plates into the ties, and a reduction of surface bends resulting from insufficient support given by poor ties.

When rail is to be renewed during freezing weather, it is impracticable to renew ties prior to its installation. The work required and the results obtained make tie insertions at this time a distinct disadvantage.

Aluminum in Railway Buildings

To what extent is structural aluminum adaptable for use in railway building? What are its special advantages? Its limitations?

Increased Use Warranted

By Fred M. Lehrman
Architectural Engineer, Railway Division, Reynolds Metals Company, Chicago

Taking the word "adaptable" first in its physical sense, aluminum—or any material—to qualify as a structural member must have sufficient strength to perform its function as part of a structure, be capable of fabrication and assembly by presently accepted or correspondingly simple methods, and be available in sufficient quantities and forms for a complete structure. By these criteria, aluminum is adaptable to a great many railroad structures which fall into the general classification of buildings.

Aluminum is now available in all the standard structural shapes commonly used in buildings. It is rolled in sheets and plates of adequate range of thickness and size, in corrugated sheets of sufficient strength to carry roof loads on the usual purlin spacings. Beyond the scope of this question, but neverthless having a distinct bearing on adaptability, are many architectural products, such as roofing and siding materials, windows, and rain carrying equipment which are a necessary complement to the structural forms mentioned above, since they make it possible to build complete buildings of aluminum.

Structural aluminum is fabricated by ordinary methods, and erected by bolting or riveting. The only departure from standard practice is in the driving of the larger sizes of rivets, which must be heated, in which case some method of controlled heating, such as electric or salt-bath heaters must be used. Where aluminum comes in contact with other metals, simple methods of separation (painting contacting surfaces with bituminous paint or aluminum paint, use of building paper, felt, or similar means) will give complete protection against electrolytic action.

Advantages of aluminum are its lightness, permitting savings in weight where needed, either during erection or permanently, and its resistance to most forms of corrosion found around railroad properties. This permits substantial savings in maintenance as well as economy resulting from long life.

The only point where aluminum may be at a disadvantage is in first cost comparisons. The cost of aluminum per pound is considerably higher than that of structural steel, for instance. But since one pound of aluminum equals three pounds of steel in volume, area, or length, the difference in cost of such units of a structure is much less than the difference in price per pound. Thus the material cost may be somewhat higher for aluminum. However, this extra cost is often more than balanced out by the saving in weight, saving in maintenance, or longer life. Also, in many non-structural applications, this cost differential is actually cancelled out through fabricating and erection savings.

Aluminum is therefore adaptable for building structures such as train sheds, enginehouses, coal chutes and other structures around engine terminals, passenger shelters of the type found in suburban territories, and movable adjuncts, such as transfer bridges in freighthouses. Each proposed use should be studied, giving proper weight to the savings possible in weight and maintenance. Physical adaptability, of course, extends to a far larger classification of buildings, and as the cost of aluminum is reduced through improved methods of production this adaptability will make the advantages of aluminum more widely available.

Remember too, that aluminum structures do not require painting. This elimination of painting and repainting can often more than cancel differences in material cost between aluminum and steel.

Another factor that cannot be ignored is the long-range price trend. While the base price of aluminum is today 30 per cent below pre-war levels, thanks to new competition in the industry, the composite base price of other metals has increased more than 100 per cent . . . and it appears that this trend will continue into the future. While the supply of high-grade iron ores is diminishing rapidly, new methods of producing aluminum and cheap electricity from atomic power promise to bring the price of aluminum down still further.

Railway Use Is Spreading

By General Bridge and Building Supervisor

Following the pace of outside builders, railways are using aluminum in increasing quantities for many purposes. Practically all of the normal structural shapes and forms are available, such as angles, beams, plates and channels.

Made of aluminum alloys, these shapes can and have been fabricated into bridge girders and roof trusses. There has been little question as to their strength for such purposes. There has arisen some doubt, however, as to the ability of these alloys to withstand the corrosive effect of locomotive gases. This was evidenced in a 1947 report of the American Railway Bridge and Building Association on the Utilization of New Types of Material in Buildings, which contained a statement, "aluminum is not recommended for use around engine terminals due to the attack made upon

it by locomotive gases". However, since the presentation of this report, additional evidence has been found that such a restriction is too harsh. In recognition of this the association has revised its report so as to delete the above quotation and substitute the following: "Where aluminum metal is contemplated for use in enginehouses, consideration should first be given to the Report of Committee 13 —Application of Corrosion-Resisting Materials to Railroad Electrical Construction, Association of American Railroads, Electrical Section, 1947 Reports".

Experience thus indicates that caution in the use of structural aluminum, while yet still evident, is diminishing. As it decreases, the demand for aluminum will grow and will spread to include many more railway uses.

Using Decay-Resisting Primers

What are the advantages or disadvantages in applying primers having decay-resistant qualities before painting wooden signs, posts or wooden parts of work-equipment? Explain.

Preservatives Assist Paint

By H. M. Church
General Supervisor, Bridges and Buildings (Retired), Chesapeake & Ohio, Richmond, Va.

A primer is a paint or analogous substance applied next to the surface of the material being painted and not necessarily colored or pigmented. Excessive moisture back of the paint film is responsible for many failures of paint on exterior wood surfaces. A properly formulated priming coat will permit the moisture to pass through the film. The problems encountered are blister and peel and the various causes of bleeding. Mildew affects the durability of the paint by allowing spores of fungi to develop, softening the wood, and results in capillary attraction and depletion of the vehicle—liquid portion of the paint. A properly formulated primer will control the movement of moisture through the film.

Microorganisms causing decay are universally present in the air and will attack inadequately protected wood. This calls for the use of a fungicide in priming and finishing paints, and especially where the wood is not protected by the usual methods of preservative treatment, dry kilning and framing before treatment.

The oil-soluble chlorinated phenols have found extensive use in the millwork industries in the dip treatment of toxic solutions using atmospheric pressures for impregnation. Since these treatments improve paint adhesion, why not use them in the framing of the softwoods used in the assembly of wood signs, and use the hardwoods for the wooden parts of roadway machines and work equipment?

The "Penta" solutions, such as pentachlorophenol, being miscible in linseed oil, petroleum and creosote, as well as 30 other oils, have been used in various concentrations for this purpose for 15 years in our maintenance-of-way shops and in the treatment of framed boards and timbers for marine construction and repairs. Excellent advice on the specification and application of these preparations is contained in the Technical Bulletin No. 6, issued by the Western Pine Association, Portland, Ore., entitled "Permatol, A Preservative Treatment for Exterior Millwork".

Preserve, Prime and Paint

By F. L. Browne
Chemist, Forest Products Laboratory, U.S. Department of Agriculture, Madison, Wis.

As a rule it is not necessary to think both of painting wood and of preserving it against decay at the same time. Wood kept above ground and able to dry out promptly after it has been rained upon is not subject to attack by the fungi of decay anywhere in the United States. On the other hand, wood used where it stays damp long enough to decay readily is apt to be difficult to keep painted because changes in temperature of wet wood tend to make paint coatings blister and peel. Most paints, therefore, contain no wood preservatives, and wood used where it will surely be subject to decay is commonly treated thoroughly with a preservative and then either left unpainted or colored with an exterior wood stain.

Nevertheless, there are times when woodwork kept above ground and painted does not dry out promptly in all its parts after being rained upon. This happens when joints between members let rainwater enter readily to gain access to concealed and unpainted areas of the wood. Subsequent escape of such water is slow, for most of it must dry out by passing through the wood to an exposed surface where paint retards its evaporation. The condition may be especially bad if the wood to which penetrating water gains access is sapwood or other wood that is both rapidly absorptive of water and readily susceptible to decay. Under such circumstances there is likely to be difficulty both in keeping the wood painted and in keeping it free from bluestain and decay. Outdoor signs, platforms, steps, and railing often present such problems.

In former times wise builders postponed or prevented trouble in such structures by choosing for them the heartwood only of woods naturally resistant to decay. Another procedure in which older builders put much faith was the painting of the concealed wood surfaces of joints subject to penetration of water. Such painting was done after the wood had been cut and fitted and before it was assembled. Nowadays we cannot be so choosey about our wood and it is usually impracticable to have carpenter and painter on the job at the same time or to let the carpenter apply paint.

The modern way of minimizing trouble in structures of the kind in question is to apply a water-repellent preservative before the painting is done. Water-repellent preservatives are mineral-spirits solutions of a suitable wood preservative—a material repellent to water—and other necessary ingredients. The most widely used preservatives in such products are the chlorinated phenols, such as pentachlorophenol, though copper naphthenate and phenylmercury oleate are others of importance. The nature of the water repellent is not usually revealed by the manufacturer.

Water-repellent preservatives penetrate unusually well into the end-grain of sapwood and into joints between wood members. They are best applied by dipping, either immediately after all cutting, fitting, and boring have been done, or even directly after assembling the structure. Window sash, for example, are dipped after they have been assembled. When neither the pieces before assembling nor the assembled structure can be dipped, the water-repellent preservative may be applied by brushing or mopping, provided that care is taken to let end-grain wood and joints take up as much of the material as they will.

Ample time must be allowed for the mineral spirits to dry out after a water-repellent preservative has been applied, before putting on paint, else the paint may prove very slow in drying. Even when plenty of time has elapsed, there may be a slight

retardation in the drying of some paints. The ingredient that is most effective for water repellency also has a tendency to slow the drying of paints.

A water-repellent preservative is not a priming paint or a substitute for a priming paint. Treated wood still needs to be primed and finished with the same kinds and amounts of paint that would be used on untreated wood.

Preservatives such as chlorinated phenols may be incorporated in wood sealers or in priming paints. Such materials, however, do not penetrate wood deeply enough to carry the preservative where it is needed. In particular, sealers and primers fail to penetrate readily into the joints between members after structures have been assembled. Therefore, it is seldom practicable to combine the application of a preservative and part of the painting system in one operation. Preservatives and paint are best applied separately.

There are, of course, times when paint itself needs a preservative to keep the coating from being attacked and made unsightly by mildew in damp environments. For that purpose the preservatives should be incorporated in the paint, but it may still be wise to treat the wood with a water-repellent preservative for precaution against bluestain and decay in the wood.

Giving Bridge Shoes Good Bearing

What are the effective methods of obtaining a uniform bearing for bridge shoes on new or worn bridge seats?

Has Two Methods

By W. R. Marshall
Assistant Engineer of Structures, Erie, Cleveland, Ohio

To provide a uniform bearing under bridge shoes the material under them should be dense and the supporting surface should be even and parallel to the surface of the shoes. Our standard specifications for concrete masonry require that the area under a bridge shoe shall be cast ½ in. higher than the theoretical bridge seat elevation and then dressed to a true surface and horizontal plane at the proper elevation. This additional concrete is intended to make allowance for a possible shrinkage in the concrete to a point below the bridge seat level, to permit the removal of laitance and loose concrete on the surface, thus exposing the dense concrete required for good bearing, and to provide material for the development of a surface which is as nearly true and horizontal as it can be made.

We have developed two methods of repairing worn bridge seats. One method is designed for those cases where the bridge shoes have worn depressions into the bridge seat. The other is used where the bridge seats have disintegrated and cracked, thereby requiring extensive repairs. In a case where only a depression exists and the concrete or stone masonry is in generally good condition, the bridge and shoe is jacked to the right elevation and a seal is placed around three sides of the shoe, leaving the most accessible side open. Iron oxide mixed with the proper amount of moisture is then injected or blown by compressed air into the space between the bottom of the shoe and the bottom of the depression. The seal around the three sides of the shoe prevents the iron oxide from being blown out and the open side permits the air to escape. The seal is then removed and the surface of the bridge seat around the shoe is coated with waterproofing. This process and the apparatus for injecting the moisture and iron oxide was developed by the department of structures of the Erie.

In cases where the masonry, especially stone masonry, has deteriorated to a point where more extensive work is necessary, the bridge is jacked up to the correct elevation and the deteriorated masonry is removed to a predetermined depth. An I-beam grillage is then installed and wedged up until the top surface is level and in contact with the underside of the bridge shoe. The grillage is then encased in concrete, which is doweled to the original masonry and finished flush with the top of the grillage. A groove is provided at the joint between the concrete and the face of the backwall for mastic filler, and the top of the concrete, particularly along the edges of the beam flanges, is coated with waterproofing. This prevents water from entering shrinkage cracks during freezing weather and damaging the concrete.

Several Methods in Use

By J. E. Yewell
Assistant to Chief Engineer, Bessemer & Lake Erie, Greenville, Pa.

There are several methods in use for providing a uniform bearing under bridge shoes on new or worn bridge seats. These include the use of three or four alternate layers of canvas and red lead, the use of sheet lead, or the use of cement grout or concrete containing a specially prepared metallic aggregate to prevent shrinkage.

The first two methods have been used for many years with more or less satisfactory results. The third method, namely, cement grout or concrete containing a specially prepared metallic aggregate to prevent shrinkage, has been used successfully for the last 15 years. The metallic aggregate produces a material which not only does not shrink, but, in fact, expands slightly while setting. This expansion causes the grout to make a perfect contact with the bottom surface of the bridge shoe.

Desirable Tie Plate Bottoms

What are the desirable characteristics of tie plate bottoms to assist in holding track gage and minimize mechanical destruction of the ties? What design do you consider best? Why?

Wants Anchor-Bottom Plate

By G. A. Phillips
Chief Engineer, Delaware, Lackawanna & Western, Hoboken, N.J.

I have always been so greatly in favor of an anchor-bottom tie plate that I have used them exclusively for 30 years for the purpose of reducing the burden placed on the spikes, as well as to prolong the life of the ties.

I am partial to the diamond-bottom anchor plate because it does not destroy the fibres of the wood and requires no more than three spikes per plate, even on sharp curves, to hold the gage. This effects a saving in the number of spikes used and thereby reduces spike damage to the ties. It is rarely, if ever, necessary to gage track on account of the plates moving. The only time this is necessary is when the outside edges of the tie plates embed in the ties on the low sides of curves, partly due to improper eccentricity of the tie plate, causing the gage line of the rail to move out a distance depending upon the height of the rail.

I often compare the anchor-bottom tie plate, particularly the diamond type, and the smooth-bottom plate, with a new and old automobile tire, respectively. When a tire becomes old and smooth you generally replace it with a diamond tread. It has always seemed to me that our smooth-bottom tie plate, turned up at the ends, is designed about the way one would design a sleigh runner, which you desire to move freely without resistance. Such a smooth-bottom plate puts the entire burden or load on the spikes for holding the gage of track.

Certainly a proper anchor-bottom tie plate requiring no more than three spikes, and not damaging the tie, is more economical than a smooth-bottom plate with four or more spikes, which certainly increase the damage to the tie.

I hope that the diamond-bottom plate will be adopted by the A.R.E.A. and that it will be widely used to the extent that manufacturers will not charge an extra for rolling it.

Waffle Pattern Is Best

By W. H. Sparks
General Track Inspector (Retired), Chesapeake & Ohio, Russell, Ky.

Many considerations enter into the question of desirable characteristics of tie plate bottoms. Nearly every large railroad has designed tie plates to its own standard at one time or another. Some have been designed for several rail sections, some for special fittings and hold-down devices, some with flat bottoms, some with ridges running one way, others with the ridges running the other. Some have ridges running both ways. The fact that there are so many designs indicates that none that has been used yet is outstandingly better than any other or it would have been adopted universally.

At the present time railroads are concerned with reducing the wear on the tie under the plate, or the so-called cutting action of the plate. It is important to reduce that wear, but to me greater damage occurs to the tie from filling it so full of spike holes. Driving and redriving spikes into a tie will ruin it quickly.

Therefore, I think the best tie plate is one that has some method of improving the lateral holding power of the spikes. If the number of spikes could be reduced to no more than two, except on very sharp curves, ties would last a lot longer. From my observation, the tie plate that gives the best holding action is the one with the waffle bottom. I have checked ties on which these plates had been used and have found that they were damaged very little by the waffle pattern. But best of all, they had not been spike-killed.

Smooth Plates Best

By William Lindsey
Yard Foreman, Chicago & Illinois Midland, Pekin, Ill.

My first recollection of tie plates is that of the old calk type, having calks like those on horse shoes, that had to be driven into the tie before it could be spiked. It goes without saying that this did irreparable damage to the tie. Later there was the plate with sharp ridges running its full length or width. This plate, too, had to be imbedded in the tie with much resultant damage. Gradually all these characteristics of the earlier tie plates were reduced, each design lessening the height of the ridge, until now there is no ridge.

This latest development, the smooth bottom, with holes inserted for independent spiking, is the best. Such spiking holds the plate firmly in place. With less movement of the plate, the breaking of the top fibres of the tie is reduced to the minimum, and gage and line are benefitted. Although tie plates have been improved a great deal during these many years, they have not kept pace with the increase in the size of the rail. They are still too small. To decrease tie cutting I think they should be larger.

Maintaining Curves for Diesels

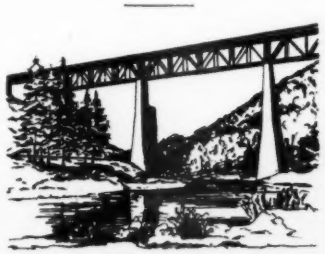
Has the increased use of Diesel locomotives had any effect on the maintenance of curves? If so, in what ways? Explain.

Diesels Lower Maintenance

By H. J. Weccheider
Engineer M. of W., Erie, Youngstown, Ohio

On the Erie at present we have in service eighteen 4-unit freight Diesels, seven 3-unit passenger Diesels, and 57 Diesel switchers. The oldest of our road Diesels have been in service three years. Due to the fact that some of our trains are still being pulled by steam power, it is difficult to determine how much effect Diesel power has on the maintenance of curves. However, we do know that there has been a decided effect in reducing maintenance, and that with the anticipated purchase of additional Diesel power, maintenance will be further reduced.

The effect of Diesel locomotives on maintenance is not restricted to curves only, as we are sure tangent track can also be better and more economically maintained as to rail wear, surface, alinement and ballast cleaning. The following reasons substantiate the effect on the maintenance of both curved and tangent track as a result of the operation of Diesel power as compared with steam power.



(1) Diesel power eliminates the pound on the rail that is inherent in a reciprocating steam locomotive, where it is impracticable to eliminate all hammer blow. There are no counter balances involved with the Diesel driving wheel; hence no pounding is produced from this cause. This has a favorable effect on increasing the life of rail and reducing surface maintenance, particularly at joints. The elimination of the pound will also have a favorable effect on lengthening the life of ties.

(2) Diesel power has its load more evenly distributed over a much longer section of track, reducing concentrated strains. The maximum power developed (tractive effort) by a driving wheel is approximately 25 per cent of the weight on the wheel. Steam locomotives commonly have axle loads of 70,000 to 75,000 lb. per axle, with the axles spaced close together, causing a rigid wheel-base effect, which has a tendency to crowd the high rail, resulting in excessive rail wear, wide gage and irregular alinement. In contrast, Diesel locomotives are loaded from 50,000 to 55,000 lb. per axle, and the wheels are spaced much farther apart, employing a greater number of axles. This has a favorable effect on track surface and wear on the high rail, as well as on alinement and the gage of curves.

(3) The power delivered to the Diesel driving wheel is a uniform torque for the full revolution as against a pulsating torque on the

steam locomotive driver, varying from nothing to a maximum, twice per revolution of each wheel. When the maximum torque is being exerted on the right-hand wheel, the torque on the left-hand wheel is zero, and vice versa. Based on this, Diesel power rides more evenly around curves, reducing curve wear, variations in gage and irregular alinement, as well as resulting in a great reduction in wheel slippage. Wheel slippage causes engine burns on the rail. Such burns sometimes result in internal fractures which, in time, cause the rail to break under traffic.

(4) The use of dynamic brakes on Diesel locomotives usually holds the train in check more uniformly when going down hill or slowing down for speed-restrictions to the extent that air brakes are seldom needed except where stops are made. This braking has a favorable effect on reducing rail creeping, as a unit horizontal force applied to one rail at a time will cause less creeping effect than when the same value of force is applied to each of a series of rails connected together, such as occurs when air brakes are applied to an entire train by a steam locomotive.

(5) On ascending grades, where both freight and passenger trains operate on the same track, Diesel power pulling freight trains can operate at a higher rate of speed than steam power. This results, where consistent with the elevation in curves, in more even distribution of weight on the high and low rail, thus reducing rail wear and corrugation, particularly on the low rail of curves. The center of gravity of Diesels, being lower than that of steam locomotives, also tends to make for more even distribution of the weight on both rails.

(6) Due to the elimination of stack ashes and blow-off from steam boilers, the operation of Diesel power will greatly reduce the amount of fouled ballast. The intervals between cleaning of ballast will be increased, resulting in decreased maintenance costs.

(7) In yards, Diesel power has a favorable effect in reducing wear and alinement difficulties at switches, frogs and guard rails.

Trucks for Water Service Men

Where highway motor trucks are used by water service repair crews, what type and capacity of truck is best adapted? Should it be specially equipped in any way? How?

Trucks Are Great Assets

By H. W. Kellogg

Division Engineer, Chesapeake & Ohio, Pere Marquette District, Detroit, Mich.

This is a subject in which I am very much interested and also one in which I have made some experiments. I have recently fitted out a truck for some of my water service repairmen and plan to fit out another as soon as a truck is available. My observations and recommendations on this matter are summed up as follows:

In choosing a truck for the use of water service repairmen, the first consideration is to determine what type of chassis is desired to give the proper capacity for the load to be carried. The pipe fittings and tools of a water service mechanic are heavy and the capacity of the truck, therefore, should be sufficient to carry all the equipment and materials necessary without overstrain. To do this, a truck of one-ton capacity is needed.

The truck should be equipped with a closed body having end doors that can be locked. A standard body furnished by the manufacturer could be used, but one that is cheaper and more practical can be constructed in the company's own shops. The inside of the body should be fitted with racks for holding a small number of pipe fittings and tools. Care should be taken, however, not to overload the truck with more tools and fittings than are absolutely necessary. A good vise should be placed at the rear of the truck, located to one side so that there will be an open aisle through the center of the body. This aisle makes it possible to carry a standpipe spout or other bulky material in the truck.

Brackets should be placed on the outside of the body on the right side and also on the right front fender. These can be used for transporting a few lengths of pipe. There should also be movable spot lights on the front and back of the truck and an electrical connection near the rear doors where a long extension cord can be connected.

A truck properly equipped for the use of water service repairmen shows a direct saving in efficiency in doing routine work, enables the men to cover more territory, is a great asset in cases of emergency and, in the long run, will show a saving in the operating costs of the water service department.

Trucks Are Indispensable

By Water Service Engineer

The type and capacity of highway truck that is best adapted to water service repair crews depends, to a large extent, on the type of facilities that have to be maintained. Where the maintenance is concerned chiefly with relatively small items, such as centrifugal pumps, general heating and plumbing facilities, Diesel fuel oil stations, shallow wells, etc., a small truck will suffice. For such purposes a ¾-ton utility pick-up truck is ideal.

To be most effective such a truck should be equipped with a 2-in. gasoline powered dewatering pump; cabinets for miscellaneous pipe fittings; brackets for holding oxygen and acetylene tanks; boxes for gauges, hose and cutting and welding torches; and tool boxes for small tools, rope, chain blocks, etc. The cabinets and boxes for fittings and equipment can usually be arranged along each side of the body, and the tool box in the front.

For territories where the facilities to be maintained are larger, such as deep wells, large pump houses, etc., a 1½-ton platform-body truck is most serviceable. This type of truck should be equipped with a 12,000-lb. winch behind the cab, and a demountable A-frame for use in pulling wells, handling standpipes, large pumps, etc. This frame, when not in use, can be slung under the truck. Tool boxes can be built along both sides for the many miscellaneous items needed by the repair crews. Oxygen and acetylene tanks and equipment can be carried in a manner similar to that on a smaller truck.

Trucks that are so equipped and in charge of a division water service foreman can satisfactorily service a territory extending as much as 100 mi. each side of headquarters. Without the assistance that such highway vehicles give to the present-day water service man, who no longer has the local train service he used to have, his day would never end and the cost of repairs would be enormous.

It might be well to mention that while panel trucks have been used to some extent for the lighter work, most repairmen prefer to use a pick-up. The greatest advantage claimed for the panel is that it can be locked up, but so can good tool boxes.

PRODUCTS OF MANUFACTURERS

New, improved equipment, materials, devices

(For additional information on any of the products described in these columns, use postcards, page 635)

Attachments for Crawler Compressor

SCHRAMM, Inc., West Chester, Pa., has introduced two new attachments —a backfill blade and a power take-off —for its Model 60 crawler compressor. Also, it has developed a rubber-tired trailer on which the crawler compressor may be mounted and towed over a highway by means of a truck or automobile.

The new backfill attachment is intended primarily for use in backfilling ditches or trenches, and in moving loose material generally. When mounted on the crawler compressor the backfill blade is operated hydraulically by a pump driven by a V-belt from a pulley mounted in front of the crawler's generator pulley. The control for lifting and lowering the blade is conveniently located within easy reach of the operator.

The power take-off for the Model 60 crawler is available in either the straight splined-shaft type or the right-angle belt type. Using the first-mentioned type other pieces of equipment may be driven by means of flexible shafts and universal joints. Pumps and other equipment mounted directly on the crawler unit may also be driven by the straight splined shaft. The right-angle belt take-off may be used for operating belt-driven equipment of the type which requires a wide belt, such as pumps and power saws. At a speed of 2,200 r.p.m. the power take-off of either type has a rating of 10 hp.

The new trailer for the Model 60 crawler is mounted on two wheels with pneumatic tires. The body has two channels in which the tracks of the crawler rest when it is mounted in position. The body is hinged in such a manner that, with the aid of skid boards and boxes, the crawler may be loaded and unloaded from the trailer while it is still attached to the towing vehicle. The trailer is equipped with five tool boxes in which tools and the skid boards may be kept. It is equipped with electric brakes which may be operated from a unit mounted on the steering column of the towing vehicle. When the crawler is mounted on the trailer it is fastened in place by a chain through the front wheels and by another chain hooked under the crawler drawbar and tightened by means of a turnbuckle arrangement.

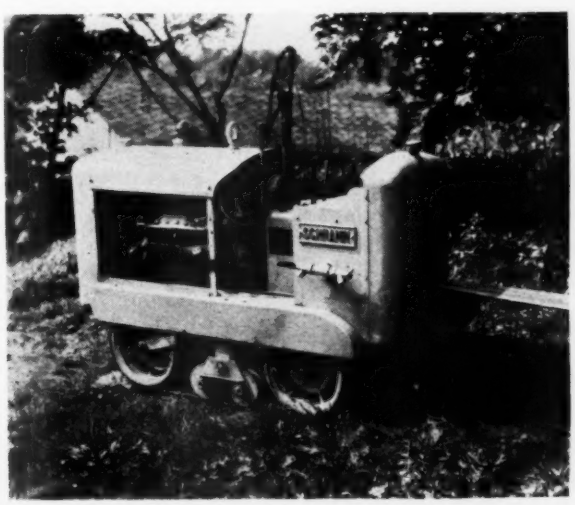
Penta Weed Killer

A WEED killing material, called Penta Weed Killer, is now being offered by the Chapman Chemical Company, Chicago. This material, it is claimed, is effective on all types of vegetation, including grasses; will not sterilize the soil; can be diluted with either water or oil; and does not bring about a particular fire hazard.

Penta Weed Killer is a general contact herbicide concentrate combining solutions of chlorinated phenols with highly aromatic petroleum oils. The addition of the chlorinated phenols, it is said, has been shown by laboratory tests to be very effective in increasing the natural weed-killing properties of such oils. To bring about low application costs and reduce fire hazards the concentrate has been designed for dilution with water by the addition of an emulsifying agent. The emulsion formed when water is used is said to be relatively stable, requiring only a slight amount of agitation to maintain stability. It is not considered poisonous to grazing cattle. The concentrate can, of course, be diluted with oil when conditions make it desirable.

When undesirable vegetation is

A Model 60 crawler compressor fitted with a backfill blade



A Model 60 crawler compressor equipped with a power take-off

A track through a pole yard, which has been sprayed with Penta Weed Killer

sprayed with the water solution, the weaker plants, it is claimed, will generally be killed outright, including the roots. Strong-rooted perennials will not be killed by one spraying and will eventually grow back. Consequently, if it is desired to kill the roots of such weeds, several sprayings may be required during the first year.

New Electrode

DESIGNATED as the Airco No. 387, a new all-position arc-welding electrode of the E 6012 class for the welding of mild steel has been developed by the Air Reduction Sales Company, New York. The characteristics claimed for the new electrode include the following: (1) A deposited bead that is smooth and of the proper contour; (2) excellent operating characteristics on both alternating and direct current; (3) a minimum of spatter when used with either alternating or direct current; (4) satisfactory operation in all positions, especially when welding vertically down; (5) a high degree of welding performance throughout the entire length of the electrode when high welding currents are used; (6) exceptionally easy slag removal; and (7) more inches of weld per electrode. This electrode is available in 1/8-in., 5/32-in., 3/16-in., and 1/4-in. diameters.

Segmental Washer

AN improved type of washer, known as the Teco Segmental Washer, has been developed by the Timber Engineering Company, Washington, D.C. This washer is reported to speed up bolt-tightening jobs on timber structures, with consequent reductions in labor costs.

This washer is made in two identical malleable cast-iron segments which are applied to the bolt from the sides, and which are shaped in such manner that they interlock with each other. Hence, since the washers can be applied without first removing the nuts, considerable time is said to be saved by using them to take up the slack in bolts due to shrinking of the timbers. A clearance of only ¼ in. is required to insert the segments under a nut.

Friction, applied automatically when the two segments are pressed together, is said to hold them together so securely that shock or vibration will not separate them. They can, however, be separated for removal and reuse by means of a prying slot provided for that purpose.

The Teco Segmental Washer assembled, and the individual identical segments

Welding Electrodes

THE Champion Rivet Company, Cleveland, Ohio, has developed a new welding electrode for use in welding rail ends. Known as the Railend electrode, the new product is said to deposit a weld whose hardness will increase under the rolling action of the wheels of cars and locomotives, but not to such an extent that cracking or spalling will occur. The time spent in grinding the weld produced is claimed to be reduced because they can be deposited in thin layers.

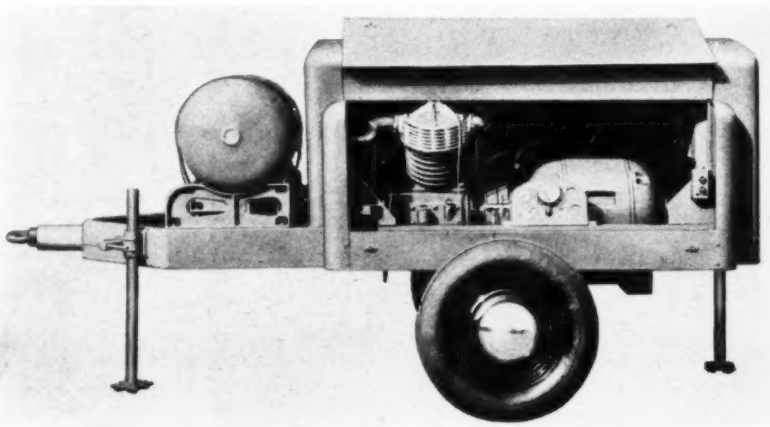
The Railend electrode will operate on either direct or alternating current, with direct current being most generally used. It is said to produce a Rockwell hardness of 34 to 40, depending to a large extent on the kind of parent metal on which it is deposited. The deposited analysis of the electrode is as follows: Carbon, 0.28; manganese, 0.46; silicon, 0.28; sulphur, 0.025; chromium 1.77; vanadium, 0.10.

Electric-Driven Portable Compressors

THE Davey Compressor Company, Kent, Ohio, recently announced the development of a new line of portable electric compressors in five different capacities ranging from 60 to 315 c.f.m. Available in skid, two-wheel trailer and four-wheel trailer mountings, the new units will be known as Air Chief "Electrics".

The compressors are of two-stage construction with intercoolers and safety valves. They are direct driven from 1200 r.p.m., 220/440-volt, 3-phase, squirrel-cage motors. Starters are of the across-the-line, magnetic non-reversing type, equipped with thermal-relay overload protection.

(*Please turn to page 620*)



One of the Davey Compressor Company's Air Chief "Electric" Air Compressors

(For additional information regarding any of the products described on this page, use post cards, page 635)

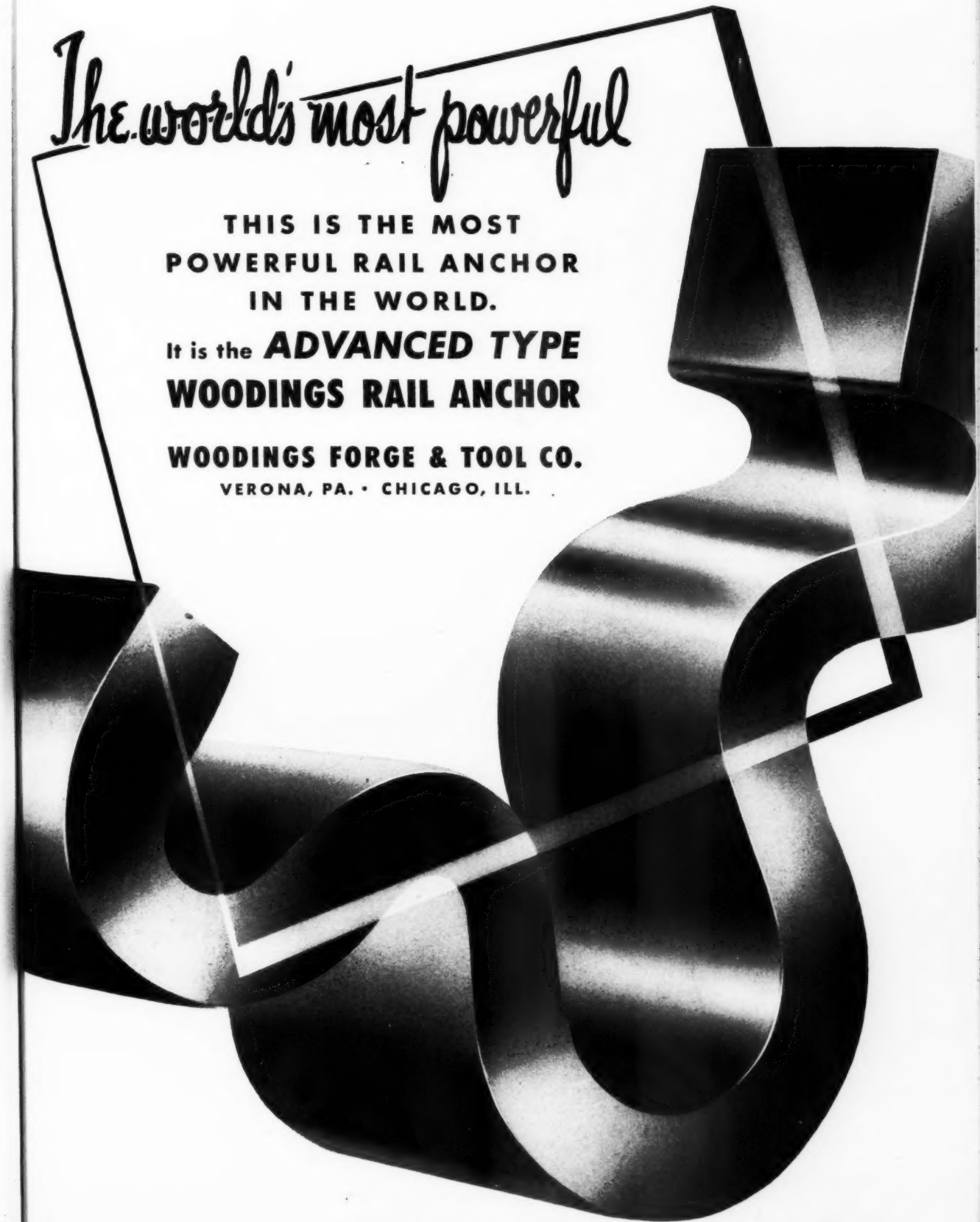
The world's most powerful

THIS IS THE MOST POWERFUL RAIL ANCHOR IN THE WORLD.

It is the *ADVANCED TYPE* WOODINGS RAIL ANCHOR

WOODINGS FORGE & TOOL CO.

VERONA, PA. • CHICAGO, ILL.



Motor Car with Generator

THE Kalamazoo Manufacturing Company, Kalamazoo, Mich., has developed a new generator-equipped motor car, the Kalamazoo No. 56E, which can be used not only as a regular section car but also as an electric power source for operating power tools.

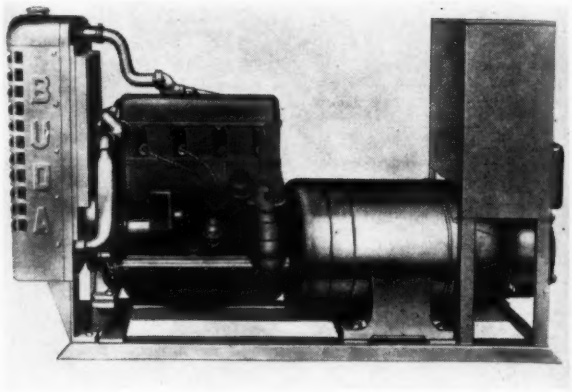
Left—The Kalamazoo No. 56E motor car operating an electric-driven saw

The motor car has a two-cylinder, lightweight, air-cooled engine, and direct-connected to the engine, a 3-kw., 110-volt, a-c generator with four outlets for operating electric-driven tools.

The car has a two-speed selective gear transmission allowing two speeds forward and two in reverse, with final drive by chain. It is equipped with an oil-bath air cleaner, a high-tension magneto and Timken axle housing mounted in rubber cushions. The body of the motor car is of all-steel construction with compartment for tools and lunch pails. Its capacity is six men, with tools.

Generator Sets

Right—One of the new line of Buda gasoline-electric generator sets



A NEW line of gasoline-powered electric generator sets, designed for continuous or stand-by service in meeting the needs for auxiliary power in a variety of construction and industrial applications, is now being produced by the Buda Company, Harvey, Ill. The line includes 23 sizes and models ranging from 10 kw. to 125 kw. It also includes both alternating-current and direct-current generators for single-phase or three-phase current. Each set is a complete unit and is fully equipped with generator, engine, radiator, and engine controls.

Four-cylinder engines are provided with the smaller units, while those in the larger models have six cylinders. The engines are water cooled and are lubricated by a circulating pressure system. If desired, natural-gas or butane engines may be substituted for the gasoline engine in any unit in the line.

The generators, connected directly to the engines, are of the single-ball-bearing, heavy-duty, drip-proof type, said to conform to standards of the American Institute of Electrical Engineers and the National Electric Manufacturers' Association. A control panel is provided with each unit complete with voltmeter, ammeter, circuit breaker, rheostat and engine controls.

What Our Readers Think

Criticism of Salt Not Well Founded

Detroit, Mich.

TO THE EDITOR:

I feel it a duty to the general engineering profession to comment on misstatements in the contribution of E. M. Grime on page 159 of the February issue of *Railway Engineering and Maintenance* entitled, "Don't Use Salt."

First of all, the statement is inconsistent in saying that "instead of attempting to make a concrete which is resistant to strong alkaline salts, the use of these salts should be prohibited", and then later stating that "terrazzo or concrete are about the only common floors not affected by tracked-in salt."

The statement is also made that salt causes serious deterioration of any wood surface. This is entirely incorrect. Dry salt, salt brine and process brine are being stored at the present moment in literally thousands of wood bins, tanks, barrels, casks, etc., in chemical plants, meat packing plants, tanneries, salt plants and many other places. Salt and brine most definitely do not cause deterioration of wood.

Another statement is made that salt is injurious to carpets or wearing surfaces in passenger cars. This again is contrary to the facts. Salt has no effect whatever on carpets, clothing or other fabrics. As a matter of fact, salt is widely used in the textile industry in setting the dyes in fabrics of all types.

The use of "clean, sharp sand", recommended by Mr. Grime, would have a much worse scrubbing, abrasive or cutting effect on carpets, linoleum surfaces, wood floors, or any other type of floor material or covering than salt.

The suggestions made of storing sand adjacent to furnaces or hot steam pipes and of using radiant heating are entirely infeasible in the majority of cases. Salt is being used on sidewalks, city streets, railroad switch points and elsewhere on a scale of hundreds of thousands of tons, and the usage is growing steadily.

D. W. KAUFMANN
Chief Chemical Engineer
International Salt Co., Inc.

(For additional information regarding any of the products described on this page, use post cards, page 635)

Study these eight valuable features

Capacity 60 cubic feet per minute actual air at 100 pounds p.s.i. Perfect for four tampers or other tools.

Motor-driven crawler treads to position compressor anywhere, on or off the track.

Easily self-loaded on rail dolly, trailer, or truck for fast transportation to the job.

Unique, compact power plant. Both the motor and the compressor cylinders are balanced in a V-8 block.

Push button starting.

Simple driving controls. Complete maneuverability.

Quickly adaptable to such general purposes as towing, backfilling, and operating stationary machinery (saws, pumps, etc.)

Famous Schramm dependability that comes from 40 years of experience building portable compressors.

WHEN a maintenance engineer is introduced to Schramm's Model 60 Crawler, there is not much for us to say about it. For this versatile compressor's advantages are so self-evident that after one look a man is full of his own ideas for using it. He sees at once how perfect it is for spot tamping and, with added units, for bigger jobs as well. Usually he itches to sit behind the controls, touch the starter, and go places.

Everyone says we have done a great job in designing and building the Model 60 Crawler, and you will agree when you have actually seen and handled one. But as a prelude to that, why not get all the facts about it? They are presented in Bulletin FC 48. Write Schramm's Railway Sales Division today for your copy.

Be sure to visit the Schramm display at Booth 3201 - 3212 The American Road Builders Show July 16th to 24th, Chicago, Illinois

SCHRAMM INC.

THE COMPRESSOR PEOPLE
WEST CHESTER
PENNSYLVANIA

THE MONTH'S NEWS

Happenings among the railways—the associations—the suppliers

Increase in Railway Purchases

Purchases by Class I roads of materials, supplies and fuel, exclusive of equipment, during the first two months of 1948 were up about 12 per cent from the 1947 figure for similar items. Equipment orders during the comparable periods were almost exactly the same, with orders totaling $128,497,000 for the first two months of 1947, and $128,319,000 for the same period of 1948. Outlays for materials, supplies and fuel during the first two months totaled $307,087,000 and $343,534,000, respectively, for 1947 and 1948. February purchases of all items, with the exception of equipment and ties, showed increases from the 1947 figures.

Freight Rates Increased

Additional freight rate increases, which will yield about $300 million a year, were authorized by the Interstate Commerce Commission in a report made public on April 13. At the same time the commission gave the railroads permission to put the increases into effect in 10 days notice, as a result of which the necessary tariffs were placed on file on April 26, and the new rates went into effect on May 6. This latest increase substitutes an overall advance of 21.4 per cent for the increase of slightly more than 17 per cent which became effective January 5 to supplant the first of three interim adjustments—an 8.9 per cent boost—that had been in effect since October 13, 1947.

Chicago Railroad Fair

Work is well under way on the Railroad Fair which is to be held on Chicago's lake front from July 20 through September 6, in commemoration of the 100th anniversary of the operation of the first locomotive out of Chicago. Participating railroads have subscribed in excess of $1,000,000 for the capital cost of the fair, and many roads are planning to have individual exhibits at a total additional expenditure of approximately $1,000,000. The fair, which leading U. S. railroads intend to make the most spectacular large-scale exposition since the war, is to assume proportions of a continent-wide centennial, reflecting overall railroad progress. The principal railroads of Canada and Mexico have also been invited to participate.

High on the list of fair attractions will be a pageant presented on a stage 450 ft. wide. There will also be a narrow-gage railroad on which visitors may ride from one end of the grounds to the other. Other highlights will be exhibits of railway equipment manufacturers designed to show developments in the various types of equipment used by the railroads, indoor and outdoor theatre attractions, and night-time fireworks. A series of exhibition tracks will be installed for the display of the name trains of 1948—including the "Train of Tomorrow"—as well as all types of passenger and freight cars, both historic and modern.

Railroad Capital Outlays to Hit All-Time High in 1948

According to figures compiled and released by the United States Department of Commerce the capital expenditures of the railroads of the United States in 1948 are expected to total more than $1.6 billion, or more than 50 per cent larger than the previous all-time record ($1,059 million), which was established in 1923. The estimated outlay for 1948 compared with capital expenditures for 1947 of $920 million, and will represent an increase of more than 75 per cent as compared with that figure. The expenditures for 1948 will, moreover, be approximately three times those for each of the years 1945 and 1946. In discussing these figures the Department of Commerce, in a recent issue of its "Survey of Current Business", pointed out that the capital expenditures of the railroads are showing a strong upward trend at a time when those of other business groups are tending to level off or to decline.

Changes in Railway Personnel

General

William R. Devenish, vice-president of the Western region of the Canadian National, with headquarters at Winnipeg, Man., and an engineer by training and experience, has retired under the pension rules of the company.

J. F. Pringle, vice-president and general manager, Central Region, Canadian National, who formerly served as resident engineer and assistant engineer on this road, has been appointed vice-president, with headquarters as before at Toronto, Ont.

J. T. Stotler, assistant superintendent of the Northern Pacific, and an engineer by training and experience, has been promoted to superintendent, with headquarters as before at Fargo, N.D.

Engineering

J. E. Bebb, assistant engineer structures of the New York Central, with headquarters at Detroit, Mich., has retired.

J. H. McFadden, assistant engineer of the Missouri Pacific, with headquarters at St. Louis, Mo., has retired.

E. H. Wieder, assistant engineer in the office of the auditor of capital expenditures of the Chicago & North Western, with headquarters at Chicago, has retired after 42 years of service with the company.

James Lundie, division engineer on the Canadian Pacific, with headquarters at Schreiber, Ont., has been transferred to London, Ont., replacing **T. A. S. Munford,** who has been transferred to Toronto, Ont., to succeed **V. A. G. Dey,** who has retired.

F. S. Hutton, assistant division engineer on the Canadian National at London, Ont., has been promoted to division engineer of the Hornepayne division, with headquarters at Hornepayne, Ont., succeeding **H. J. Fast,** who has been transferred to the Levis division at Levis, Que.

G. L. Plow, division engineer at Levis, has been transferred to the London division, with headquarters at London, Ont., succeeding **J. Ferguson,** promoted.

W. T. Donoho, district engineer of the Gulf, Colorado & Santa Fe (part of the Atchison, Topeka & Santa Fe System), has been appointed acting chief engineer of the G. C. & S. F., with headquarters as before at Galveston, Tex., to succeed **W. H. Rochester,** whose death is reported elsewhere in these columns. **J. G. West,** division engineer of the Panhandle & Santa Fe (also part of the Santa Fe System), at Slaton, Tex., has been promoted to district engineer at Galveston, to replace Mr. Donoho, and **R. D. Bisbee,** general foreman bridges and buildings and water service, at Dodge City, Kan., succeeds Mr. West as division engineer at Slaton.

(*Continued on page* 624)

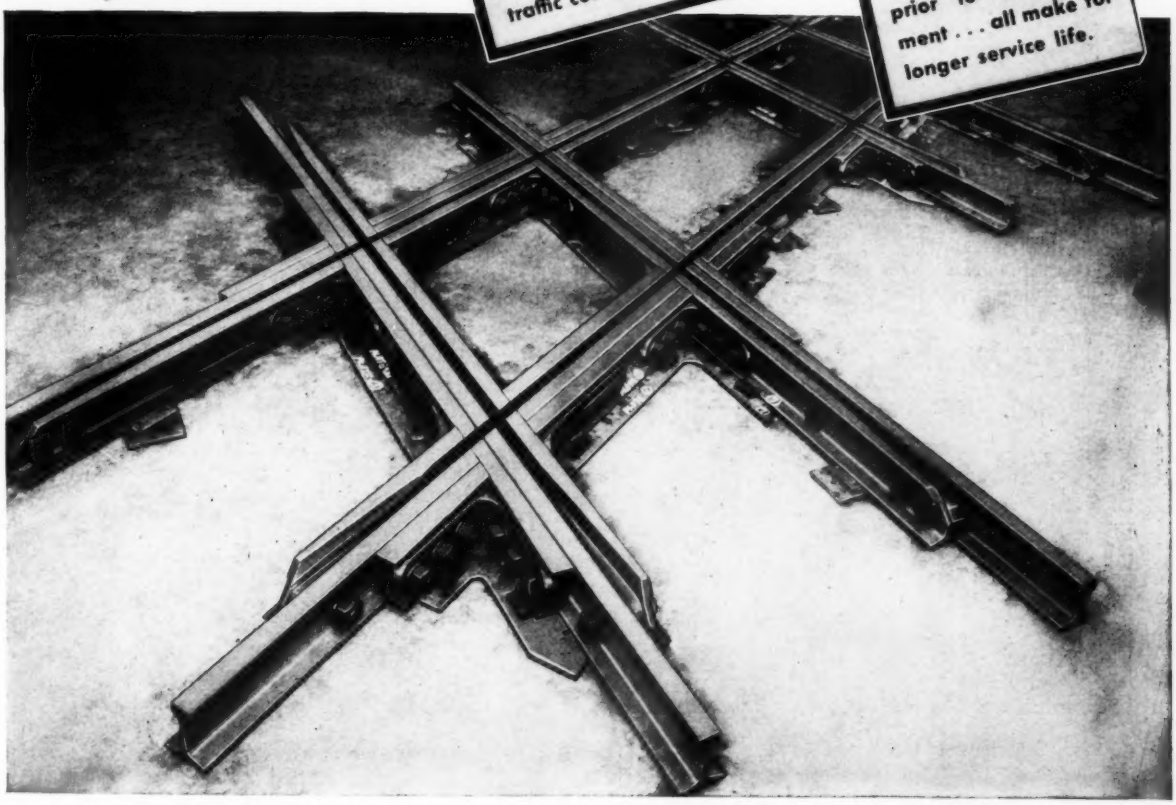
WEIR KILBY *Heat-treated* CROSSINGS *for* BETTER PERFORMANCE

...WITH *Low Cost Maintenance!*

LOWER FIRST COST
For most conditions and where the going is toughest, heat-treated constructions will be found lower in first cost and cheaper to maintain.

Rugged
Ruggedness, stability and the built-in Weir Kilby features enable Weir heat-treated crossings to stand up under the most severe traffic conditions.

LONG SERVICE LIFE
The proven durability of heat-treated steel, plus our method of fabricating and pre-assembly of all parts prior to heat-treatment . . . all make for longer service life.



Standard and Special Track Work for Steam Railroads Since 1882

WEIR KILBY CORPORATION

CINCINNATI 12, OHIO — Successors to — BIRMINGHAM 7, ALA.

WEIR FROG CO. . . . KILBY FROG & SWITCH CO. . . . CINCINNATI FROG & SWITCH CO.

Railway Personnel (Cont'd)

Benjamin T. Leland, draftsman on the Delaware, Lackawanna & Western, at Scranton, Pa., has been promoted to assistant engineer on the M. & E. division, with headquarters at Hoboken, N.J., to replace the late **John S. Friery.**

L. H. Hornsby has been appointed engineer of structures and communications of the Norfolk Southern, with headquarters at Norfolk, Va. He will have jurisdiction over bridges and buildings and the telegraph, telephone and signals departments.

R. H. Beeder, division engineer of the Eastern division of the Atchison, Topeka & Santa Fe, with headquarters at Emporia, Kan., has been promoted to district engineer, Eastern district, Eastern lines at Topeka, Kan., to succeed **F. Helm,** who has been transferred to the Western district, Eastern lines, with the same headquarters, succeeding **W. A. Kingman,** who has been appointed division engineer of the Southern Kansas division, with headquarters at Chanute, Kan., succeeding **A. F. Ewert.** Mr. Ewert has been transferred to the Oklahoma division, with headquarters at Arkansas City, Kan., replacing **H. L. Miller,** who has been transferred to Emporia to succeed Mr. Beeder.

Roy W. Putnam, whose appointment as engineer maintenance of way and structures of the Southern Pacific, at San Francisco, Cal., was noted in the April issue, was born at Buffalo Gap, S.D., on March 23, 1888, and received his higher education at State Normal college, Spearfish, S.D., and Colorado college, receiving a degree of Bachelor of Science in civil engineering from the latter school in 1912. In August of that year he entered the service of the Southern Pacific as an axeman, and subsequently advanced through the positions of chainman, rodman and instrumentman until 1917, when he was promoted to assistant engineer at Bakersfield, Cal. In 1918 he was transferred to Portland, Ore., and from 1921 to 1925 he served as general track foreman on the Portland division. In 1926 Mr. Putnam was promoted to roadmaster, with headquarters at Eugene, Ore., and in November, 1928, he was further advanced to assistant division engineer at Portland. Two years later he was appointed division engineer at El Paso, Tex., and in April, 1943, he was promoted to assistant engineer maintenance of way and structures, with headquarters at San Francisco, which position he was holding at the time of his recent appointment.

Roy W. Putnam

S. L. Mapes, assistant chief operating officer of the Jersey Central Lines, has been appointed chief engineer, with headquarters as before at Jersey City, N.J., succeeding **Albert M. Zabriskie,** who has retired from active duty after 44 years of service with the railroad. Mr. Zabriskie will continue to serve in an engineering consulting capacity. **Harold R. Bausch,** assistant engineer, has been appointed principal assistant engineer in the chief engineer's department.

S. L. Mapes

Mr. Mapes was born at Port Jervis, N.Y., on June 15, 1890, and entered railroad service in 1911 as assistant foreman (student) in the track department of the Erie at Carlstadt, N.J. In August, 1911, he went with the Central of New Jersey as rodman, becoming engineering clerk in the maintenance of way department in July, 1913, and chief material inspector in November, 1915. Mr. Mapes was appointed assistant supervisor of track in June, 1918; assistant engineer in 1920; assistant engineer maintenance of way in 1923; engineer maintenance of way of the Central division in August, 1926; engineer maintenance of way of all divisions in July, 1932, and assistant chief operating officer on May 1, 1945.

Track

J. A. McKay, roadmaster on the Canadian National, at Halifax, N.S., has retired after 29 years of service.

R. S. Roller, assistant cost engineer of the Chesapeake & Ohio, has been appointed assistant supervisor of track, with headquarters at Columbus, Ohio.

Sam Hass has been appointed assistant roadmaster of the Chicago, Rock Island & Pacific, with headquarters at El Reno, Okla., succeeding **Rex Price,** who has been transferred at his own request.

L. T. J. Bonfardin, assistant supervisor of track on the Pennsylvania, at Dery, Pa., has been promoted to supervisor of track, on the Panhandle division with headquarters at Carnegie, Pa., to succeed **W. A. Thomson,** who has been transferred to Hicksville, L.I., where he replaces **P. C. Smedley** who has been appointed inspector maintenance of way, at Jamaica, N.Y. **E. L. Clausing,** assistant supervisor of track, at York, Pa., has been transferred to Dery, to succeed Mr. Bonfardin, and **W. B. Super,** junior engineer on the New York division, has been promoted to assistant supervisor of track on the Maryland division, with headquarters at York, succeeding Mr. Clausing.

W. R. Thomson, roadmaster on the Denver & Rio Grande Western, at Alamosa, Colo., has been appointed roadmaster at Salt Lake City, Utah, succeeding **H. V. Meek,** who has been transferred to Alamosa. **W. R. Ancell** has been appointed roadmaster, with headquarters at Kremmling, Colo.

C. H. Hanson, assistant roadmaster on the Missouri Pacific, has been promoted to roadmaster in charge of the system rail laying gang, with headquarters as before at St. Louis, Mo., to succeed **E. T. Hasty. L. E. Minton** has been appointed assistant roadmaster, with headquarters at Chester, Ill., succeeding **W. W. Warren,** who has resigned.

Thomas J. Reagen, assistant supervisor of track on the Central of New Jersey, at Somerville, N.J., has been promoted to supervisor of track, with headquarters at Ashley, Pa., to succeed **LeRoy J. Shea,** who has been transferred to Somerville, where he in turn succeeds **Edward F. Burke,** who has been appointed track inspector, a newly created position, at Jersey City, N.J.

E. K. Pearson, roadmaster on the Chicago & North Western, at Madison, Wis., has been transferred to DeKalb, Ill., to succeed **A. E. Benson,** who has been appointed roadmaster at Sterling, Ill., where he replaces **E. A. White,** whose appointment as roadmaster at Chicago was reported in the May issue. **J. T. Peabody,** roadmaster at Antigo, Wis., has been transferred to Fond du Lac, Wis., to succeed **M. A. Haessly,** transferred, and **L. J. Schwabe** succeeds Mr. Peabody at Antigo. **F. A. Haase,** roadmaster at Norfolk, Neb., has been appointed roadmaster at Antigo, to replace Mr. Schwabe.

Bridge and Building

G. R. Collier, acting roadmaster on the Panhandle & Santa Fe (part of the Atchison, Topeka & Santa Fe System), at San Angelo, Tex., has been appointed general foreman bridges and buildings and water service, with headquarters at Dodge City, Kan., to succeed **R. D. Bisbee,** whose appointment as division engineer is noted elsewhere in these columns.

Obituary

William H. Rochester, chief engineer of the Gulf, Colorado & Santa Fe, at Galveston, Tex., died in St. Mary's hospital in that city on April 25, following an illness of several weeks.

(Continued on page 626)

"HERBICIDOL"

A Chemical Weed Killer With a Record That Tells a Convincing Story

AS WE read almost daily, the extensive publicity now being given to the subject of chemical weed killers, it becomes quite apparent that the public have suddenly become weed conscious.

Within our organization one man can say—"MY PAPPY HAS BEEN TALKING AND WRITING ABOUT WEED KILLER FOR THE PAST FORTY YEARS!"

AND HE MIGHT ADD—"AND MY PAPPY'S PAPPY MADE WEED KILLER IN ST. LOUIS, MO. IN 1883 AT A TIME WHEN THE ONLY DRINKING WATER AVAILABLE CAME OUT OF THE MUDDY MISSISSIPPI RIVER AND PRACTICALLY EVERYONE HAD TO MEDICATE FOR MALARIA."

So there are men in the READE MFG. CO. who have heard about and thought about weed killer for railroad use for three generations.

We can look back and observe with interest how conditions have changed. The original weed killer was powerful but dangerous to use where live stock roamed. Non-poisonous weed killer created an enlarged field for the sale of weed killer.

In 1943 when UNCLE SAM shut off our supply of raw materials, it became necessary to create a new type of weed killer. Out of that necessity "HERBICIDOL" found its way into the field for railroad use. It was a poisonous base weed killer with the killing power that a poisonous base material can assure.

Slowly but surely as railroads have studied "HERBICIDOL," they have changed their viewpoint. It is no longer regarded as a war time substitute but rather as a product that has properties all its own. These properties are such that it has in many cases replaced both the old type poisonous and non-poisonous weed killer.

There are good sound reasons why this is so.

LET US GIVE YOU SOME FACTS ON THIS IMPORTANT SUBJECT.

READE MANUFACTURING COMPANY

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Jersey City, N. J.

Service Headquarters
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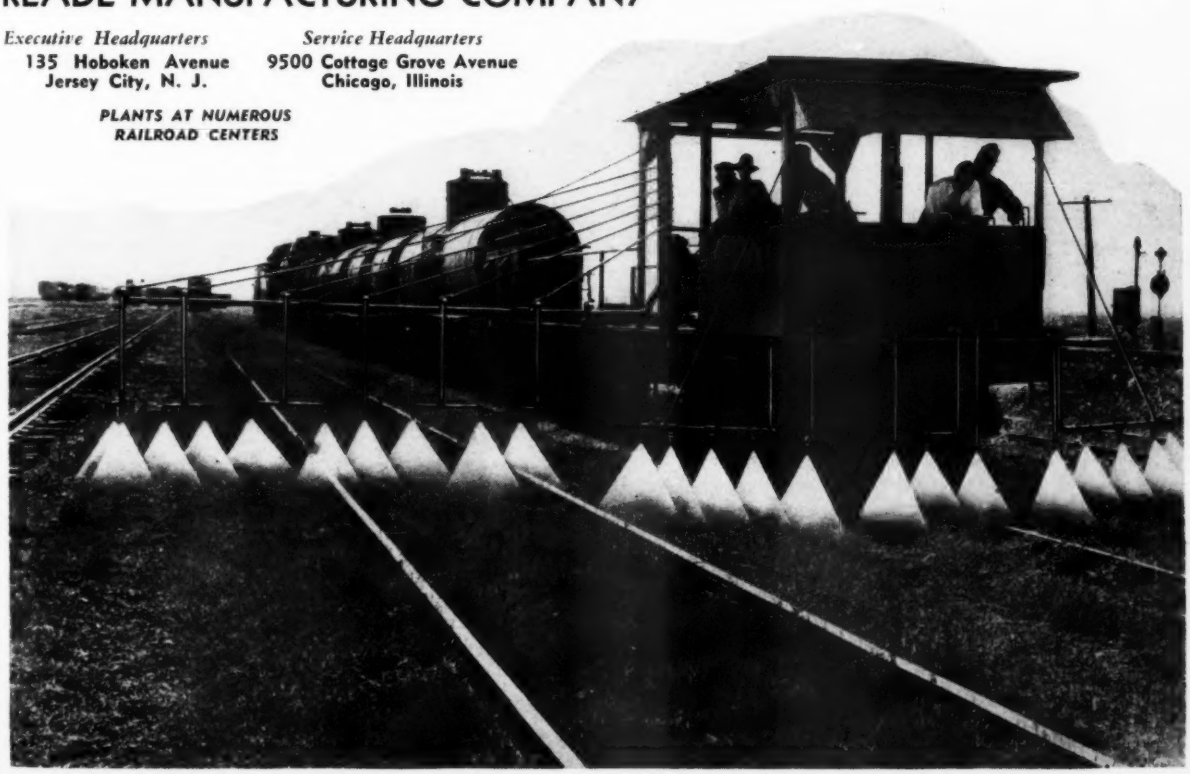
Chicago, Illinois

PLANTS AT NUMEROUS RAILROAD CENTERS



Railway Personnel (Cont'd)

B. C. Daugherty, former track inspector of the Chicago, Milwaukee, St. Paul & Pacific, died on May 1.

Arthur Montzheimer who retired in 1939 as chief engineer of the Elgin, Joliet & Eastern at Joliet, Ill., died on May 20.

Colin M. Ingersoll, who participated in the early development of the New York, New Haven & Hartford, and served as its chief engineer from 1900 to 1905, died on April 7.

George E. Boyd, who retired on January 1, 1947, as associate editor of *Railway Engineering & Maintenance,* and Railway Age, with headquarters at Chicago, died

George E. Boyd

at the Englewood Hospital in that city on May 14, following a long illness. Mr. Boyd was born at Roseville, Ill., on February 26, 1874, and was graduated by the University of Illinois in 1896 with the degree of Bachelor of Science in civil engineering. He first entered railroad service in 1897, as a track apprentice with the Illinois Central, and subsequently served as rodman, instrumentman, resident engineer, assistant engineer—maintenance, and assistant engineer—construction. He was appointed roadmaster in 1904, which post he held until 1911, when he joined the Delaware, Lackawanna & Western as superintendent of bridges and buildings. He was appointed division engineer with that road in 1913, and in 1923 he became associated with the Railway Review as engineering editor. When the Railway Review was purchased in 1927 by the Simmons-Boardman Publishing Company (now Corporation), publishers of *Railway Engineering and Maintenance* and Railway Age, he was appointed associate editor of the Railway Engineering and Maintenance Cyclopedia, also a Simmons-Boardman publication. Mr. Boyd served in this capacity until 1929, when he was advanced to the positions he held at the time of his retirement. Two of his outstanding accomplishments as associate editor of *Railway Engineering and Maintenance* and Railway Age were his conduct for 18 years of the "What's the Answer?" department in the former, and his preparations of annual summaries in the latter.

Association News

National Railway Appliances Association

At a recent meeting of the board of directors it was decided to present a manufacturers' exhibit in conjunction with the Half-Century Annual Meeting of the American Railway Engineering Association in Chicago, March 14-17, 1949. While the A.R.E.A. will hold its meeting at the Palmer House, as in past years, the exhibit will be held in the Coliseum, convenient to the convention headquarters, with every attempt to make it more comprehensive than any exhibit in the past.

Wood-Preservers' Association

More than 460 members and guests attended the forty-fourth annual convention of the association in St. Paul, Minn., April 27-29. During the three-day session, a total of 24 technical reports and 14 papers was crowded into a program which also included visits to nine wood-preserving plants.

Of special interest to maintenance-of-way officers as timber users were reports on some of the newer chemical preservatives, with new tentative specifications for pentachlorophenol and copper naphthenate; reports on methods of fireproofing wood, including a favorable report on the performance of chromated zinc chloride and chromated zinc chloride (FR) as fire retardants; the report on seasoning practices, with specific reference to vapor drying and the use of phenyl-mercury-oleate, urea and borax-boric acid, and methylolurea; a study of the preservative and fire-retardant treatment of laminated bridge members; an address by C. E. Ekberg, bridge engineer of the Northern Pacific, describing the reconstruction of the Northern Pacific's large ore dock at Superior, Wis., with treated timber; and a series of reports on service tests of ties, poles, posts and piles.

In the election of officers for the ensuing year Vice-President G. B. McGough, superintendent of Bond Brothers, Louisville, Ky., was advanced to president; J. S. Giddings, superintendent, treating plant of the Atchison, Topeka & Santa Fe, Somerville, Tex., was advanced from second vice-president to first vice-president; R. W. Gottschalk, American Lumber & Treating Co., was elected second vice-president; H. L. Dawson was re-elected treasurer; and the following were elected to the executive committee—D. L. Lindsley, J. H. Baxter & Co., Los Angeles, Cal.; C. S. Sizemore, assistant manager, Forest Products Bureau, Illinois Central, Memphis, Tenn.; R. A. Bescher, manager treating department, Wood Preserving Division, Koppers Company, Orrville, Ohio; and J. A. Vaughan, research engineer, Southern Wood Preserving Company, Atlanta, Ga. In addition, F. D. Mattos, Oakland, Cal., was elected an honorary member. St. Louis, Mo., was selected for the convention next year, which will be held April 26-28.

Metropolitan Maintenance of Way Club

E. T. Moore, chief executive officer, Central Railroad of New Jersey, was the principal speaker at the last meeting of the club which was held on April 29 at the Hotel Sheraton, New York, with 48 railroad men and 39 supply men present. Speaking on Taking the Guesswork out of Maintenance, Mr. Moore called for greater uniformity of maintenance standards and advocated a more constant level of expenditures for maintenance of way instead of the present practice of permitting these expenditures to fluctuate between extreme limits.

In the election of officers, L. H. Jentoft, division engineer, Erie, Jersey City, N.J., was elected president, J. B. Bell, engineer of track, New York, New Haven & Hartford, New Haven, Conn., was elected first vice-president; and J. R. Van Lenten, roadmaster, New York, Susquehanna & Western, Hackensack, N.J., was elected second vice-president. J. S. Vreeland, New York, was re-elected secretary-treasurer.

The next meeting of the club is to be the annual outing and will be held at the Out O'Bounds Aero & Golf Club, Suffern, N.Y., on June 17. The program, which will include contests in golf, horseshoes, quoits and softball, will begin at 10 a.m. A luncheon will be served beginning at 1:30 p.m.

Meetings and Conventions

American Railway Bridge and Building Association—Annual meeting, September 20-22, 1948, Hotel Stevens, Chicago. Elise LaChance, secretary, 431 S. Dearborn street, Chicago 5.

American Railway Engineering Association—Annual Meeting, March 15-17, 1949, Chicago. W. S. Lacher, secretary, 59 E. Van Buren street, Chicago 5.

American Wood-Preservers' Association—H. L. Dawson, secretary-treasurer, 1429 Eye street, N.W., Washington 5, D. C.

Bridge and Building Supply Men's Association—Joint exhibit with Track Supply Association, September 20-22, 1948, Hotel Stevens, Chicago, during concurrent conventions of American Railway Bridge and Building Association and Roadmasters' Association. E. C. Gunther, secretary, 122 S. Michigan avenue, Chicago 3.

Maintenance of Way Club of Chicago—Next meeting, October 25, 1948. Headquarters 105 W. Adams street, Chicago 3.

Metropolitan Maintenance of Way Club—John S. Vreeland, secretary, 30 Church street, New York.

Railway Tie Association—Annual meeting, August 30-September 1, 1948, Greenbriar Hotel, White Sulphur Springs, W. Va. Roy M. Edmonds, secretary-treasurer, 610 Shell Building, St. Louis 3, Mo.

National Railway Appliances Association—Annual exhibit, Chicago, March 14-17, 1949, in connection with the A.R.E.A. convention. R. B. Fisher, secretary, 1 No. LaSalle street, Chicago 4.

Roadmasters' and Maintenance of Way Association of America—Annual meeting, September 20-22, 1948, Hotel Stevens, Chicago. Elise LaChance, secretary, 431 S. Dearborn street, Chicago 5.

Track Supply Association—Joint exhibit with Bridge and Building Supply Men's Association, September 20-22, 1948, Hotel Stevens, Chicago, during concurrent conventions of Roadmasters' Association and American Railway Bridge and Building Association. Lewis Thomas, secretary, 59 E. Van Buren street, Chicago 5.

Roadmasters' Association

The Executive committee of the association will meet in Chicago on June 12 to review the six technical committee reports now under way. All committee chairmen are invited to this meeting in order that they might present their reports in person and incorporate suggestions made by the Executive committee. Another important feature of the meeting will be the setting up a definite program for the annual meeting to be held in Chicago September 20-22.

Track Supply Association; B. & B. Supply Men's Association

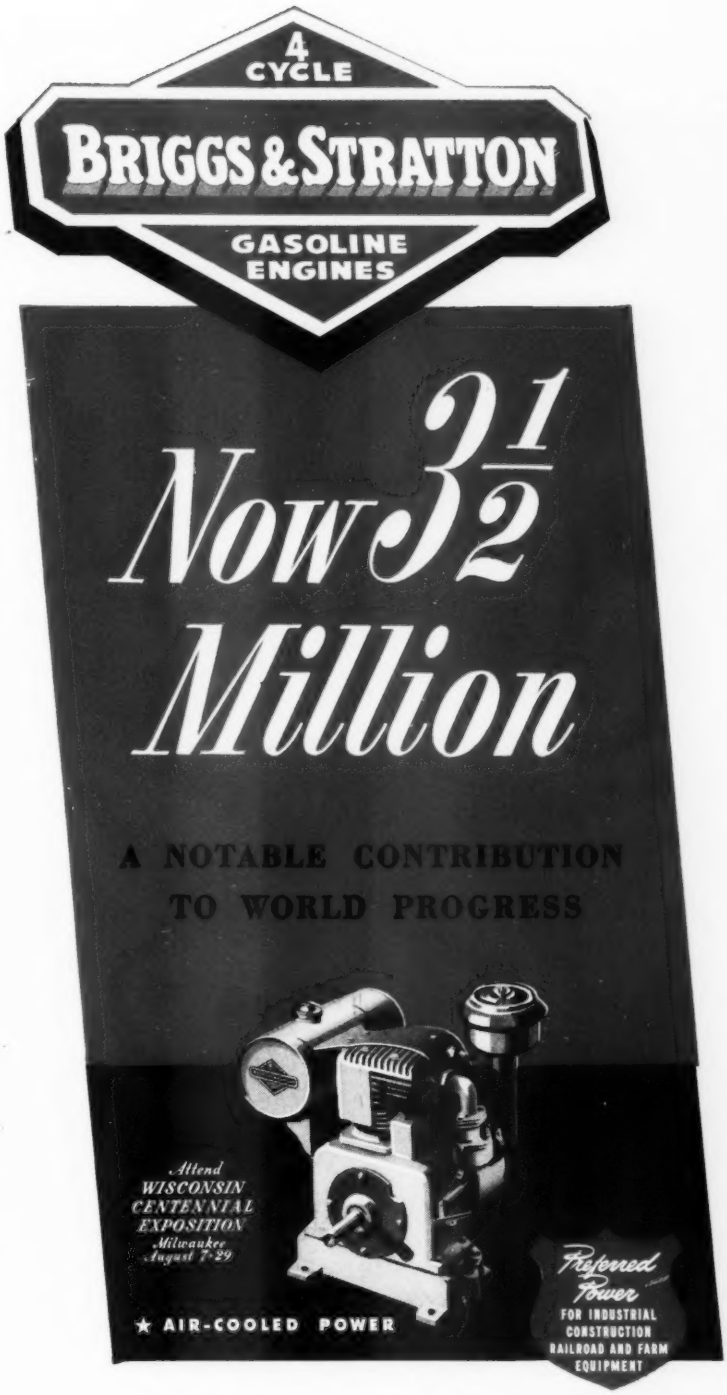
At the time of going to press 56 companies had already contracted for 100 booths at the joint exhibit of these two associations to be held at the Hotel Stevens, Chicago, on September 20-22 in conjunction with the concurrent annual meetings of the Roadmaster's and Bridge and Building Associations. That the applications for exhibit space are coming in much faster than a year ago is indicated by the fact that, at the same time in 1947, a total of 42 companies had contracted for 62 booths at the exhibit last September. Applications for space at the joint exhibit should be addressed to Lewis Thomas, director of exhibits, 59 E. Van Buren St., Chicago.

American Railway Engineering Association

A total of nine committees of the association have scheduled meetings to be held during June. These are as follows: Yards and Terminals at Cleveland, Ohio, June 2; Buildings at New York, June 3 and 4; Highways at Chicago, June 8; Waterproofing at Chicago, June 10; Wood Bridges and Trestles at Madison, Wis., June 10-11; Maintenance of Way Work Equipment at Huntington, W. Va., June 10-11; Economics of Railway Labor at New York June 22 (with an inspection trip over the Delaware, Lackawanna & Western scheduled for the 23rd); Economics of Railway Location and Operation at St. Paul, Minn., June 23 and 24; and Water Service and Sanitation at Chicago, June 29.

As part of the plan to take full advantage of the association's semi-centennial year President Mottier has appointed a Membership Development committee under the direction of F. S. Schwinn, assistant chief engineer, Missouri Pacific Lines, as chairman. Members of this committee include John E. Armstrong, chief engineer, Canadian Pacific; John E. Faning, assistant to chief engineer, Illinois Central System; P. O. Ferris, chief engineer, Delaware & Hudson; F. H. Hanger, chief engineer, Missouri-Kansas-Texas Lines; S. R. Hursh, assistant chief engineer-maintenance, Pennsylvania; H. T. Livingston, chief engineer maintenance of way and structures, Chicago, Rock Island & Pacific; E. E. Mayo, chief engineer, Southern Pacific; W. C. Perkins, chief engineer, Union Pacific; H. F. Sharpley, chief engineer, Central of Georgia; and G. L. Sitton, assistant chief engineer, Southern System.

(*Continued on page 628*)


4 CYCLE
BRIGGS & STRATTON
GASOLINE ENGINES
Now 3 1/2 Million
A NOTABLE CONTRIBUTION TO WORLD PROGRESS
Attend WISCONSIN CENTENNIAL EXPOSITION Milwaukee August 7-29
★ AIR-COOLED POWER
Preferred Power FOR INDUSTRIAL CONSTRUCTION RAILROAD AND FARM EQUIPMENT

The 3½ millionth Briggs & Stratton 4-cycle gasoline engine has recently come off the production line — headed for a job that requires *dependable* power. For 30 years these engines have met the most exacting demands on appliances and on industrial, railroad, construction, and farm equipment. The preference for Briggs & Stratton engines is a tribute to the experience and skill of the men and women who build them.

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For Maintenance Savings . . .

STOP RUST
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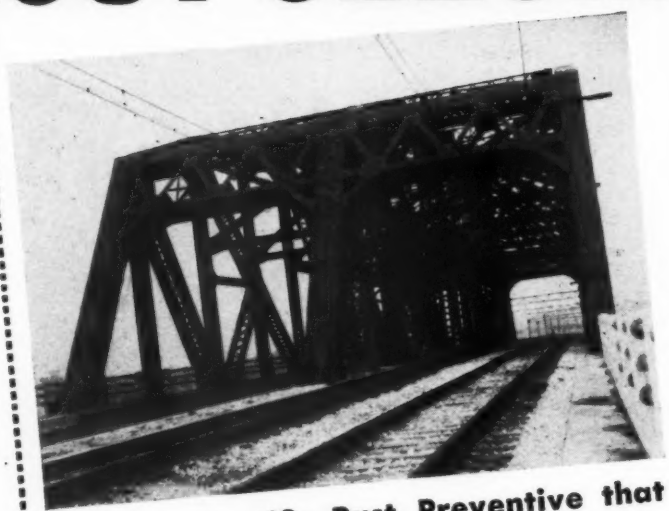

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- No sandblasting, flame cleaning or chemical dissolvers are necessary. Merely wirebrush to remove rust scale, dirt, etc.

Rust-Oleum Goes on Faster
- It saves 25% on application time and covers 30% more area per gallon. Excellent coverage, gallons of economy.

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- Rust-Oleum outlasts ordinary materials two to ten times on most jobs, depending on conditions, under which it's used.

Rust-Oleum Rust Preventives can help you to achieve greater net profits by a considerable reduction in the cost of maintenance of all rustable metal surfaces. Indoors or out—*wherever rust threatens*—Rust-Oleum cuts losses from rust. IT CAN BE APPLIED DIRECTLY OVER RUSTING METAL—by brush, dip or spray. It's tough, elastic, weatherproof!

The use of Rust-Oleum adds extra years of service to rolling stock, bridges, metal buildings, right-of-way structures, signal equipment, tanks, towers, etc. Rust-Oleum provides lasting protection for an average of ½ cent a square foot per coat material cost.

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EASY TO USE . . . LASTING SATISFACTION APPLY BY BRUSH, DIP OR SPRAY

RUST-OLEUM CORPORATION

2417 Oakton Street Evanston, Illinois

Association News (Cont'd)

Bridge & Building Association

President J. S. Hancock has called a meeting of the Executive committee in Chicago on June 28 to review preliminary drafts of the eight technical committee reports now in preparation. It is requested that all committee chairmen be at this meeting in order to present their reports in person and to receive the benefit of any suggestions made by the Executive committee.

Another feature of this meeting will be the formulation of a preliminary program for the annual meeting to be held in Chicago, September 20-22.

Maintenance of Way Club of Chicago

The feature of the annual meeting of the club, held in Chicago on April 26, was the honoring of charter members, 20 of whom were guests and took part in a program conducted by W. S. Lacher, secretary-treasurer of the club from its formation in 1921 until 1938. In the election of officers for the ensuing year, beginning with the next meeting in October, W. G. Powrie, engineer maintenance of way, C.M.St.P.&P., and first vice-president, was advanced to president; S. H. Shepley, assistant chief engineer, E.J.&E., and second vice-president, was advanced to first vice-president; V. V. Holmberg, assistant engineer, Belt Railway of Chicago, and a director, was elected second vice-president; E. C. Patterson, assistant chief clerk, office of engineer maintenance, C.&N.W., was elected secretary-treasurer, succeeding C. R. Knowles; and Neal D. Howard, editor *Railway Engineering and Maintenance*, was re-elected executive secretary. New directors were elected as follows: T. A. Blair, chief engineer system, A.T.&S.F.; J. E. Fanning, assistant to chief engineer, I.C.; F. A. Hess, division engineer, Indiana Harbor Belt; and G. E. Johnson, advertising manager, The P.&M. Co.

Supply Trade News

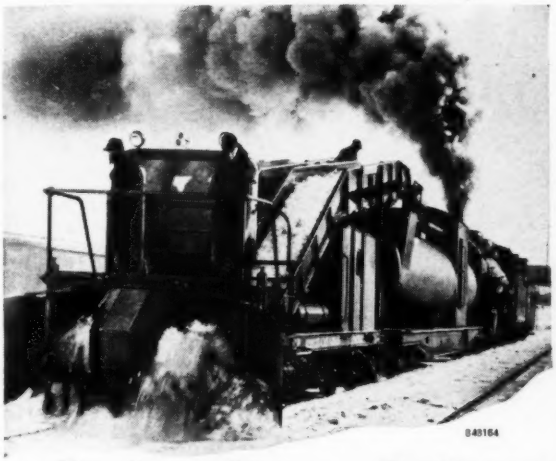
General

The Independent Pneumatic Tool Company has announced the opening of a new administration building adjacent to its main works at Aurora, Ill. The new building, which cost $1,500,000, provides office space involving an area of 40,000 sq. ft. on two floors, and additional space of 35,000 sq. ft. for machine shop, factory and steel storage. It will accommodate the company's entire executive and administrative staff.

Koppers Company, Inc., has announced new consolidated sales offices in New York and Chicago. The offices in New York will be located at 350 Fifth avenue, and will accommodate the Chemical di-

(*Continued on page* 630)

Keep yards open—trains moving



• Barber-Greene Railroad Snow Loader-Melter

New York . . . Milwaukee . . . Toronto . . . Chicago . . . where will massed drifts jam yards, clog rail centers next winter? Wherever blizzards and heavy snow may strike, railroads whose yards are equipped with the Barber-Greene Snow Loader-Melter can be sure that their yards will be cleaned faster, more effectively and at greatly reduced cost. This team has reduced snow removal costs for some roads as much as $6,000.00 per day over hand methods . . . and saved much more than that in schedules maintained.

This Barber-Greene unit consists of a BG-568 Snow Loader, a Melter Tank, with a capacity of 12,000 gallons, and the Heating Tank of 4,000 gallons capacity. Tanks are heated by direct injection of steam from the locomotive which pushes the unit. For additional information, see your Barber-Greene distributor or write Barber-Greene Company, Aurora, Illinois.

SECONDARY COALING STATIONS, with Barber-Greene specially engineered equipment, provide high capacity loading. Flexible, low-cost, adaptable to almost any track arrangement. Installation is quickly and easily made, operator needs no special training. Capacities from 1½ tons per minute up.

BARBER-GREENE COMPANY • AURORA, ILLINOIS

Barber-Greene

BEALL Hi-Duty SPRING WASHERS are made especially to stand the strain of the heavy-duty rail service required by today's high-speed freight and passenger trains.

These washers are strong and tough, yet provide the necessary "springing action" required at rail joints, frogs and crossings.

We control every step of their manufacture—from the specification of the specially-developed formula and process used in making the steel to the forming, hardening, tempering and testing operations.

BEALL TOOL DIVISION *of Hubbard* **& Co.**
EAST ALTON, ILL.

Specialist Manufacturers of Spring Washers

BEALL Hi-Duty
SPRING WASHERS
MADE ESPECIALLY FOR RAILROAD SERVICE

Only new *PROTECTO-WELD* design gives you *all three magnet features*

Investment in a welded lifting magnet, to be sound, ought to satisfy three vital requirements. They apply equally to all types of operation, whether steel mill, scrap yard, railroad or fabricating plant.

Is the magnet rugged enough for the roughest jobs? Ohio Protecto-Weld Magnets withstand hard knocks day in and out for years. Heavy-duty outer ring and top plate are welded together ON TOP OF THE MAGNET. Frequent blows against magnet side cannot crack or damage welded area. Magnet remains hermetically sealed against moisture indefinitely!

Does the magnet lift efficiently over extended periods of operation? Ohio Protecto-Weld Magnets use heavier-duty copper coils with non-cracking asphaltum insulation. They operate cooler, lift more uniformly for longer periods of operation.

Can the magnet be serviced, if necessary, quickly and economically? Since the weld on Ohio Protecto-Weld Magnets is ON TOP, it retains its shape, is never dented in. Thus, the weld can be turned down for disassembly without cutting away outer ring. Repairs are effected quickly, economically, without replacing outer pole.

Only Ohio Protecto-Weld Magnets give you *all three big advantages.* Sizes include 39, 55 and 65 inches diameter; 4, 6 or 8-coil construction. Write today for details to Ohio—*leader in magnetic materials handling.*

Ohio MAGNETS

also a leading name in the small motor field

THE OHIO ELECTRIC MFG. CO.

5916 Maurice Ave. • Cleveland 4, Ohio

Supply Trade News (Cont'd)

vision, Engineering and Construction division, Piston Ring division, Shops division, Tar Products division, and Wood Preserving divison. In Chcago, the new offices will be at 122 South Michigan avenue, and will include the Chemical division, Piston Ring division, Shops division, Tar Products division and the Wood Preserving division.

The Robert J. Wylie Company, St. Paul, Minn., has been appointed railroad distributors for the **Koehring Company,** Milwaukee, Wis. The Wylie Company will also represent the Koehring subsidiaries, **Kwik-Mix Company,** Port Washington, Wis., and the **C. S. Johnson Company,** Champaign, Ill.

Personal

Frank M. Sweeney has been appointed sales representative for **Iron & Steel Products, Inc.,** with headquarters at Baltimore, Md.

William H. Cordes, manager, market development division of the **American Steel & Wire Co.,** a subsidiary of United States Steel, has been appointed also manager of the advertising division.

David C. Affleck, general supervisor, project engineering, of the Gary (Ind.) steel works of the **Carnegie-Illinois Steel Corporation,** has been appointed assistant chief engineer there.

The Harnischfeger Corporation, Milwaukee, Wis., has announced the formation of a new division which will serve railroads exclusively. The Railroad division, which will have its offices in the main plant at 4400 West National avenue,

George A. Schmus

Milwaukee, will work closely with the railroads in supplying counsel and help in the field covered by P & H products, and will be under the jurisdiction of **George A. Schmus,** general traffic manager.

Samuel H. Gifford has been appointed sales representative of the **Wayne Crane Division, American Steel Dredge Company, Inc.,** at Fort Wayne, Ind.

(*Continued on page* 632)

For UNDERLAYMENT...

For UTILITY FLOORS...

More for your money with Asphalt Mastic!

Here's an *all-round* flooring material. Cold-laid Asphalt Mastic made with Flintkote Flooring Emulsions, for heavy duty floors and for underlayment.

Mastic underlayment adds resilience to any floor. It provides an ideal base for the finish floor. And it's particularly good for reflooring jobs, because it can be used over almost any clean, firm base.

In waiting rooms, office spaces . . . anywhere you want to spruce up a bit with a decorative flooring, make sure of a better floor by using a *mastic* made with Flintkote Flooring Emulsions.

* * *

For shops, station platforms and the like . . . where floors take a beating . . . install heavy duty mastic floors made with Flintkote Flooring Emulsions.

These durable floors are quick and easy to apply over wood, steel, concrete or almost any other firm base . . . either by power float (for large areas) or by hand application (for small spaces). Use this type for resurfacing or new construction.

Maintenance? You can almost forget it. Mastic Floors made with Flintkote Emulsions are self-healing of minor scars and rutting. Withstand heaviest traffic without damage.

And because these floors are dustless, resilient, shock-absorbing and sound-deadening, they help provide clean, comfortable, quiet working conditions.

* * *

Get complete information on Flintkote Flooring Emulsions. Write today, and ask us to tell you how you can get more for your money with asphalt mastic.

FLINTKOTE INDUSTRIAL PRODUCTS

FLINTKOTE

Products for Industry

THE FLINTKOTE COMPANY, 30 Rockefeller Plaza, New York 20, N. Y.

ATLANTA • BOSTON • CHICAGO HEIGHTS • DETROIT • LOS ANGELES • NEW ORLEANS • WASHINGTON • TORONTO • MONTREAL

THE *DIXIE* CARRIER keeps water COOL for hours

uses clean *VORTEX CUPS*

Plenty of cool water means plenty more work. The Dixie Portable Water Carrier is specially designed to refresh and invigorate your men on the job. Features include:

- Insulation that keeps water cool for hours
- Stainless steel interior that prevents rust
- Snap-lock lid for easy filling and cleaning
- Recessed faucet and steady stream for quick service
- Lightweight, durable all-metal tank in olive and chrome
- Four gallon capacity

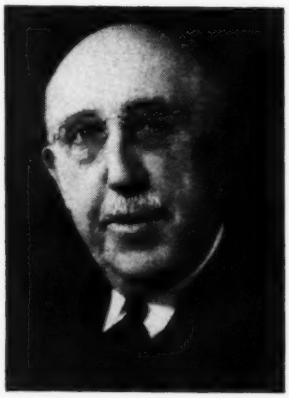
The Dixie Portable Water Carrier* dispenses inexpensive Vortex Cups, which are pleasant to use and leakproof. Clean, disposable Vortex Cups are great preventers of absenteeism caused by colds and other mouth-carried illnesses. Write for booklet on Dixie Portable Water Carrier to Dixie Cup Company, Easton, Pa.

*Also available for flat-bottomed Dixie Cups.

Supply Trade News (Cont'd)

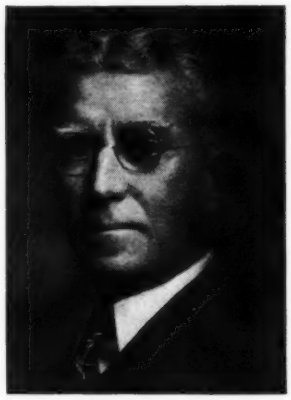
Fred A. Poor, president of **Poor & Co.,** with headquarters at Chicago, has been elected chairman, and **Victor C. Armstrong** has been elected vice-chairman, with headquarters at New York. **Philip W. Moore,** vice-president, Chicago, has been elected president.

Mr. Poor was born on April 16, 1870, at Andover, Me., and attended grammar



Fred A. Poor

and high schools at Port Chester, N.Y. He began his career in 1887 as a clerk and extra agent for the Adams Express Company in New England and remained with that firm until 1892, when he went to Chicago. From 1892 to 1893 he served as a clerk with the Hall Signal Company, and engaged in signal work with the Illinois Central from the latter year until 1900. Mr. Poor later served as a salesman for the Webber Rail Joint Company, and, when that firm was absorbed



Philip W. Moore

by the Rail Joint Company, Inc., he continued as a salesman for the latter. He also served for a time as manager of the Rail Joint Company in London, England. In 1906 Mr. Poor organized the Railway Specialty & Supply Co., primarily to market a rail anti-creeper which he invented. In 1914 the name of the company was changed to the P. & M. Co., with Mr. Poor as president. Poor & Co. was organized in 1928 to take over the

(*Continued on page* 634)

But, Prevent Tomorrow's Scrap

with Koppers Protective Coatings and Plastipitch* Protected Metal

Scrap caused by rust and corrosion can be prevented. There are specialized Koppers products for almost every corrosion problem. Each is recognized as a dependable, high quality product designed to do a specific job. They include . . .

KOPPERS PROTECTIVE COATINGS that prevent corrosion caused by heat, moisture and chemical fumes. Write for descriptive literature on Koppers Protective Coatings.

KOPPERS PLASTIPITCH PROTECTED METAL, roofing and siding—that also provide effective resistance to these corrosive conditions. Buildings constructed of this durable material are maintenance free, economical and easily erected.

Plastipitch is readily available through local distributors. Write for the manual on Plastipitch.

We welcome the opportunity to help and advise you on your corrosion problems.

KOPPERS COMPANY, INC. · DEPARTMENT 608T · PITTSBURGH 19, PA.

KOPPERS

KOPPERS SUPPLIES MANY KINDS OF WATER-REPELLENT, CORROSION-RESISTANT COATINGS.

(1) Coal-tar pitch roofing

(2) Bitumastic® Protective Coatings for pipe, structural steel and other metal, concrete, masonry and insulation. (3) Plastipitch® Protected Metal for roofing and siding of industrial and farm buildings

(4) Coal-tar waterproofing and dampproofing.

® Reg. Trade Mark, U. S. Pat. Off.

FOR TIGHT CORNERS and TOUGH SPOTS

Because Burro Cranes are designed and built to meet the specific needs of railroads, they are as efficient and practical on all maintenance-of-way, re-location or track laying as on the countless other odd jobs they do. Short tail swing of the Burro will not foul adjoining track and work can go on regardless of traffic. When Burro is working on single track, fast travel speeds and/or power set-off mechanism will get Burro off the track or to a side track in a hurry.

ONLY BURRO HAS ALL THESE FEATURES

- Fast travel speeds—up to 22 m.p.h.
- Draw Bar Pull of 7500 lbs. (often eliminates need for work train or locomotive).
- Elevated Boom Heels for working over high sided gondolas.
- Short tail swing—will not foul adjoining track.
- Low overall height—Burro can be loaded and worked on a standard flat car.

CULLEN-FRIESTEDT CO.,
1301 S. KILBOURN AVE. CHICAGO, ILLINOIS

Eye Protection for Gas Welders Who Wear Glasses

Style CW60

There's comfort for wearers of prescription glasses in WILLSON Cover-Alls* with the deep eye cups. And the adjustable leather bridge covers a danger spot and rests lightly on the nose. WILLSON-Weld* lenses are carefully matched for pairs; inspected for finest optical quality, and exceed Federal Specifications for filtering out ultraviolet and infrared rays.

Style DC50 Chip-Weld Goggles

WILLSON-WELD* Glass made in shades from 3 to 14 incl. for all kinds of gas and arc welding.

*T. M. Reg. U.S. Pat. Off.

GOGGLES • RESPIRATORS • GAS MASKS • HELMETS

WILLSON (DOUBLE)

PRODUCTS, INCORPORATED

Established 1870

243 WASHINGTON ST. • READING, PA.

For complete information on these products and their application, as well as many more eye and respiratory protective devices, get in touch with your nearest WILLSON distributor or write us direct.

Supply Trade News (Cont'd)

P. & M. Co. and a number of subsidiary companies then owned by the latter.

Mr. Moore was born on October 18, 1880, at Brookline, Mass., and received his higher education at the Massachusetts Institute of Technology, being awarded a Bachelor of Science degree in mechanical engineering in 1901. He began his career in that same year in the engineering and sales department of the Pennsylvania Steel Company, and in 1906 he joined the Railway Specialty & Supply Co. at Chicago, as general manager. When that firm became the P. & M. Co. in 1914, Mr. Moore became its vice-president, and in 1928 he became first vice-president of Poor & Co., which position he was holding at the time of his election as president.

Charles S. Weber, formerly production manager of the White Advertising Company, Cleveland, Ohio., has been appointed advertising manager of the **Thew Shovel Company,** at Lorain, Ohio.

Neil F. Ritchey, formerly metallurgical engineer for the General Electric Company at Fort Wayne, Ind., has been appointed an engineer in the technical service department of the **Reynolds Metals Company,** Louisville, Ky. The appointment of **Sublette M. Walton** as industry manager of the company's Alumni-Drome division, also was announced. Mr. Walton will be in charge of all operations connected with Alumni-Drome.

Obituary

Edward M. Deems, vice-president and treasurer of the Railroad Accessories Corporation, New York, whose death was reported in the May issue, was born on

Edward M. Deems

April 20, 1883, in Ossining, N.Y. He entered the services of the Gordon Battery Company in New York in 1898, and in 1903 was appointed western manager of the company, with headquarters at Chicago. In 1910 Mr. Deems entered the service of the Bryant Zinc Company at New York, and in 1913 he left that company to go with the Eastern Signal &

(*Continued on page 638*)

ADDITIONAL INFORMATION

On Any of the Products Mentioned in This Issue

Below is a complete index of the products referred to in both the editorial and advertising pages of this issue. If you desire additional information on any of them, use one of the accompanying addressed and stamped postcards in requesting it. In each case give name of product and page number. The information will come to you directly from the manufacturer involved, without any obligation on your part.

Products Index

A

Adzing Machines....584
Air Compressors....573, 581, 618, 621, 638, 642, 643
Anchors, Rail....562, 571, 619, 651
Asphalt....554
Asphalt Coatings....631
Augers, Power....593
Axles....588

B

Ballast Discers....588
Ballast Plows....578
Bends, Pipe....585
Bituminous Coatings....633
Blades, Backfill....617
Bolt Tighteners....637
Bolts....553, 579, 651
Buckets....599, 645
Buildings....652
Bulldozers....568, 569, 638

C

Car Bolts....651
Central Heating....563
Centrifugal Pumps....581
Chemical Weed Killer....625
Chisels....579
Cinder Plants....652
Clamps....579
Coal Bridges....599
Coal Loaders....629
Coaling Stations....652
Compressors, Air....573, 581, 618, 621, 638, 642, 643
Concrete Mixers....581
Concrete Piling....570
Corrosion-Resistant Coatings....633
Cranes....555, 560, 574, 599, 634
Crank & Balance Handles....579
Crawler Compressors....617, 621
Crawler Cranes....555, 560
Creosote Sprayers....637
Cribbing Machines....578, 584
Crossings....553, 590, 596, 623
Cups....632
Cutters, Tree, Bush, etc....648

D

Dampproofing....631
Derrick, Utility....578
Derrick Cars....588
Detector Cars....561
Diesel-Electric Cranes....574, 599
Diesel Engines....642, 643, 646
Ditchers....646
Draglines....555
Drills....587, 644, 648

E

Earthmoving Equipment....555, 564, 565, 568, 569, 639
Electric Saws....644
Electric Tools....567, 575
Electrodes, Welding....566
Emulsions....631
Engines....573, 588, 627, 646, 649
Extinguisher Cars....588
Eye Bolts....579

F

Filler Metal....648
Fire Retardants....638
Flame Hardening....556
Flange Jacks....579
Floor Resurfacer....638
Frog Plates....553
Frogs....553, 590, 596, 623
Fuel Oil Stations....652

G

Gas Masks....634
Gasoline Engines....573, 627, 646
Generators....620, 627, 646, 649
Glasses....634
Goggles....634
Grading Equipment....555, 564, 565, 568, 569, 639
Grapples....650
Grinders....645, 648, 649
Grouting Outfits....588
Guard Rail Bolts....651
Guard Rails....553, 590

H

Hammers....579
Hammers, Electric....575, 648
Hand Tongs....650
Helmets....634
Hoists & Hooks....579
Hook Bolts....651
Hydraulic Jacks....651

I

Insulation....631

J

Jacks....584, 651
Joint Bars....553

L

Lag Screws....651
Lathe Dogs....579
Lever Jacks....651
Liner Plates....572
Liquid Aluminum....654
Loaders....633, 639

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Product and Page No.....

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Company .....

Address.....City.....Zone.....State.....

(Please Fill Out Card in Full)

Lock Nuts....651
Locomotive Cranes....559, 574
Lubricators, Rail....551

M

Magnets....630
Metal Filler....648
Metal Piles....576
Mobile Cranes....560, 634
Motor Car Accessories....588
Motor Cars....588, 620
Motor Graders..564, 565, 568, 569

N

Nibblers....644

O

Oil Engines....573
Oil Spray Cars....588

P

Paint, Aluminum....654
Paving Breakers....648
Piles....570, 576
Pipe....598
Pipe Cleaning....644, 648
Pipe Lining....644
Pliers....579
Pneumatic Saws....644
Pneumatic Tools....567, 581
Power Augers....593
Power Jacks....584
Power Take-off....617
Pressure Treated Wood....583
Pull Shovels....555
Pumps....573, 581, 642, 643, 647, 651
Punches....579
Push Cars....588

R

Rail Anchors....571, 619, 651, 652
Rail Braces....553
Rail Drills....584, 587
Rail Grinders....584, 645, 649
Rail Joint Oilers....637
Rail Joints....640, 641
Rail Lubricators....551
Rail Saws....647
Rail Testing....561
Rails....553
Respirators....634
Resurfacer....638
Rock Drills....573, 642, 643
Rod Ends....579
Roller Bearings....577, 588
Rotary Pumps....651
Rust Preventive....628

S

Sand Plants....652
Sanders....644, 648
Saws....644, 647, 648
Screw Jacks....651
Screwdrivers....579
Shears....644
Shovels, Power....555
Slab Trestle....570
Snow Loader-Melter....629
Socket Kits....579
Special Trackwork....553, 590, 623
Spike Drivers....567
Spike Hammers....584
Spike Pullers....584
Spike Setters....578
Spikes....553
Spreaders....646
Spring Washers....552, 629, 653
Step Joint....650
Switch Heaters....563
Switch Points....590
Switch Rods....590
Switch Stands....553, 590
Switches....553, 596, 623

T

Tamper Blades....558
Tampers, Tie....558, 573, 581, 582, 642, 643
Thumb Screws & Nuts....579
Tie Borers....587
Tie Cutters....637
Tie Pads....580
Tie Plates....553
Tie Scoring Machines....637
Tie Tampers....558, 573, 581, 582, 642, 643
Tie Tongs....650
Timber Bolts....651
Tongs....579, 650
Tool Holders....579
Tools, Electric....567, 642, 643
Tools, Pneumatic....567, 573, 642, 643
Track Dresser....578
Track Jacks....651
Track Jacks, Aluminum....638
Track Shifters....584
Track Wrenches....584, 587
Trailers....588

U

Unloaders....629

V

Vacuum Pumps....642, 643
Vibrators....648
Vises....579

W

Washer Nuts....651
Washers, Segmental....611
Washers, Spring....552, 629, 653
Water Carriers....632
Waterproofing....631
Water-Repellent Coatings....633
Weed Burners....588, 637
Weed Killers....617, 625
Weed Mowers....588
Weed Sprayers....588
Welding Electrodes..566, 618, 638
Welding Rods....638
Well Water Systems....647
Wheels....588
Wood Preservation....583, 638
Wrecking Cranes....599
Wrenches....579
Wrinkle-Bending....585

RAILWAY ENGINEERING AND MAINTENANCE June, 1948

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RAILWAY ENGINEERING & MAINTENANCE

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NEW YORK 7, NEW YORK

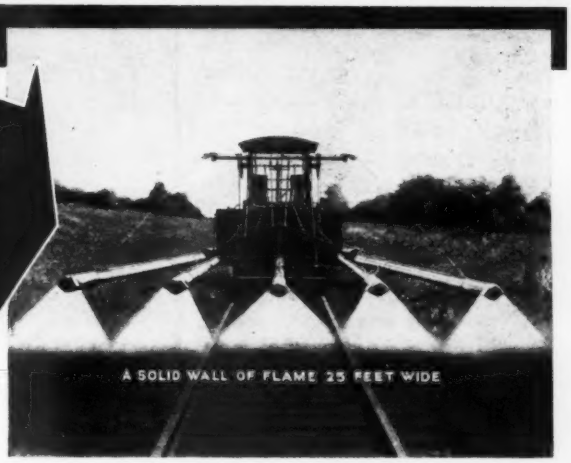
READER SERVICE DEPT.

MODERN TRAINS DEMAND
Modern Track Maintenance

AS THE "Eagles" typify the latest in transportation on the Missouri Pacific, so do Woolery Weed Burners represent the most modern and efficient method of weed eradication

WOOLERY WEED BURNERS

On more than seventy-five roads Woolery Weed Burners are setting records for fastest and most thorough maintenance of clean track all-year round . . . convincingly demonstrating in actual everyday use their efficiency in solving the burning question of weed destruction with minimum employment of manpower. Woolery Weed Burners are available in 5-burner, 3-burner, 2-burner and 1-burner Models.



Woolery 5-burner in operation
WOOLERY WEED BURNERS
5-burner, 3-burner, 2-burner, 1-burner models

Other Woolery Maintenance Units—Woolery Tie Cutters and Creosote Sprayers—are also helping many railroads maintain track the modern way, with minimum expenditure of labor, time and money.

WOOLERY MACHINE COMPANY
MINNEAPOLIS — Pioneer Manufacturers of — MINNESOTA

RAILWAY MAINTENANCE EQUIPMENT

RAILWAY WEED BURNERS . MOTOR CARS . TIE CUTTERS . TIE SCORING MACHINES . RAIL JOINT OILERS . CREOSOTE SPRAYERS . BOLT TIGHTENERS

EXCLUSIVE EXPORT REPRESENTATIVES: PRESSED STEEL CAR COMPANY, INC., PITTSBURGH, PENNA.

NO CHIPPING
NO CHOPPING

STONHARD RESURFACER

No special preparation of ruts and holes is necessary when you use STONHARD RESURFACER. Any handyman can patch or resurface your floors quickly and simply—over any week end or even in 24 hours! STONHARD RESURFACER makes your floors smooth, resilient, fireproof and wear-resistant. Traffic moves safely, and faster over STONHARD RESURFACER.

Serving the Railroads Since 1922

STONHARD COMPANY
Building Maintenance Materials
811 Terminal Commerce Building
Philadelphia 8, Pa.

Send for Free Copy of "Resurfacer Folder"

STONHARD COMPANY
811 Term. Com. Bldg., Phila. 8, Pa.

Send us a free copy of the Resurfacer folder.

Firm .....

Mr..... Title.....

Address .....

City..... Zone... State....

Supply Trade News (Cont'd)

Supply Company, also in New York. He was appointed vice-president and treasurer of the Railroad Accessories Corporation in 1922 and was holding this position at the time of his death.

Allan E. Goodhue, vice-president and a director of the Chicago Pneumatic Tool Company, at New York, died on April 20, following a short illness. Mr. Goodhue joined Chicago Pneumatic in 1919, and managed the company's interests in England until June, 1920, when he returned to this country as vice-president in charge of sales.

H. A. Morrison, retired vice-president of the Simmons-Boardman Publishing Corporation, publisher of *Railway Engineering & Maintenance*, died at the Presbyterian hospital, Chicago, on May 9, following a long illness. Mr. Morrison, who began his service with Simmons-Boardman as a sales representative at Chicago in 1925, was born on December 21, 1892, at Indianapolis, Ind. He studied electrical engineering at Purdue university, and

H. A. Morrison

in 1912 he entered the traffic department of the Pennsylvania at Indianapolis, where he remained until 1915, when he went with the Chicago, Rock Island & Pacific as a special apprentice in the electrical department at Silvis, Ill. In June, 1918, he was transferred to the office of the general mechanical superintendent at Chicago, where he remained until September 1, 1919, when he resigned to become sales engineer for the United States Light & Heat Corp., Chicago, being advanced to the position of district manager of the railway sales department on May 1, 1924. On May 1, 1925, Mr. Morrison resigned from this position to enter the service of Simmons-Boardman. On July 1, 1930, he was appointed business manager of Railway Signaling, a Simmons-Boardman publication, and on August 2, 1932, he was promoted to western manager in charge of sales in the western territory for all transportation publications of the company, at the same time continuing as business manager of Railway Signaling. He was elected vice-president of the company in November, 1937, retaining both of the aforementioned positions until his retirement.

Trade Publications

(To obtain copies of any of the publications mentioned in this column, use postcards, page 635)

Correction

In these columns of the May issue an item appeared, entitled "Bethlehem Positive Signal Stand", which gave the impression that the Bethlehem Steel Company had issued a new booklet dealing with this signal stand. This item was in error as the Bethlehem Steel Company no longer makes the signal stand referred to, nor has it recently issued any publication dealing with this stand.

Aluminum Track Jack—The Duff-Norton Manufacturing Company has released a two-page, illustrated bulletin, AD 2-248, describing its new light-weight aluminum track jack, known as Model 117-A.

New Tournadozer—R. G. LeTourneau, Inc., has issued a two-color, four-page, illustrated folder on its Model C Tournadozer. The pamphlet contains application photographs and diagrams of the new unit, and basic specifications are shown on the back cover.

Section-Gang Compressor—The Ingersoll-Rand Company has issued an eight-page illustrated brochure on its new Spot-Air compressor. In addition to describing the compressor, the bulletin contains several pictures of the unit in operation, and also lists the various tools that can be operated by the Spot-Air.

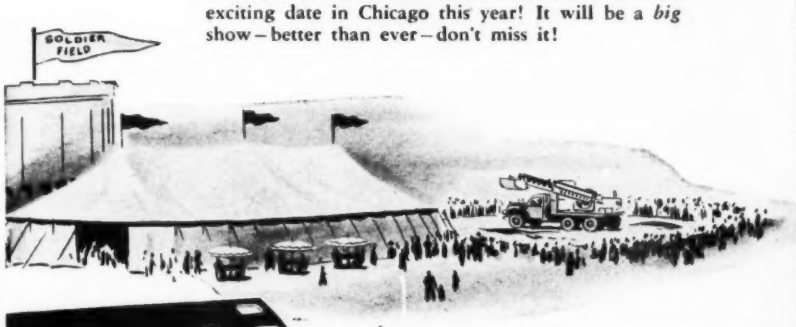
Structural Finishes—The Pittsburgh Plate Glass Company has released a 22-page booklet entitled "Railway Structural Maintenance Finishes." This book deals with both exterior and interior finishes for railway structures, and contains color charts and full information concerning applications of all types, and also gives instructions on the proper preparation of surfaces to be painted. The subject of color dynamics as applied to stations and shops also receives attention.

Welding Products for Reclamation and Hardfacing—The American Manganese Steel Division of American Brake Shoe Company has released a 28-page booklet describing its line of hard-facing and build-up rods and electrodes, and weldments. Printed in two colors and liberally illustrated with typical action pictures, the bulletin contains a description and specifications for each rod and electrode. It also has an alphabetical reference index which gives the exact rod to use for any specific application.

Fire-Retardant Wood—A new 12-page illustrated booklet on fire-retardant wood has been published by the Wood Preserving Division of Koppers Company, Inc. The pamphlet discusses "fire hazard" ratings of various building materials, the evolution of fire-retardant treatments, and methods of treating wood to make it fire-retardant. It also lists applications in which fire-retardant wood is of special value, and contains information on, and pictures of, actual cases where fire, originating in inflammable materials, was held in check by the fire-retardant wood.

The most exciting date in Chicago

● Contractors, Excavators, Construction Engineers, Maintenance Men will find their date at the big American Road Builders' Association Show the most exciting date in Chicago this year! It will be a *big* show—better than ever—don't miss it!



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Chicago

JULY 16-24, 1948

BOOTH 3821

Featuring a great new star in a spectacular personal appearance

THE
WARNER & SWASEY

GRADALL

Here you can *watch the Gradall in action,* see it perform in person, in its special arena where it has a chance to show its speed and maneuverability. Inspect the many interchangeable tools at close range—see how quickly and easily they are attached and detached . . . learn how simple and easy the Gradall is to operate.

Not only will the Gradall perform *in person* but a side show tent will show close-ups of unusual situations in motion pictures taken on actual jobs. Get the facts on how the Gradall can be applied to your job. Don't miss this Show, July 16-24, Soldier Field, Chicago!

The Gradall *in action* . . . star of the American Road Builders' Show

See the Gradall movies packed full of lively action and constructive ideas.

GRADALL
DIVISION
WARNER
&
SWASEY
Cleveland

Gradall Reg. U. S. Pat. Off.

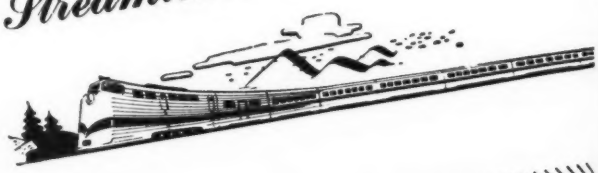
FROM COAST TO COAST—
WE LINK

THE RAIL JOINT COMPANY INC.,

—FROM BORDER TO BORDER
THE NATION

50 CHURCH ST., NEW YORK 7, N.Y.

PUT MAINTENANCE-OF-WAY *on Streamliner Schedules*



FOR SPOT TAMPING AND TRACK REPAIR WORK

You can operate four CP-3D Tie Tampers, or two CP-116 or CP-117 Spike Drivers, or any combination of tools of equal rating, from a CP Patrol Compressor, with its actual capacity of 60 c.f.m. at 100 pounds pressure.

Easily transported and handled: front and rear retractable dollies facilitate tight-spot, single-rail handling "on track," and give 4-point support "off track." Both engine and compressor are air-cooled — the CP Patrol cannot freeze and is suitable for year-round operation.

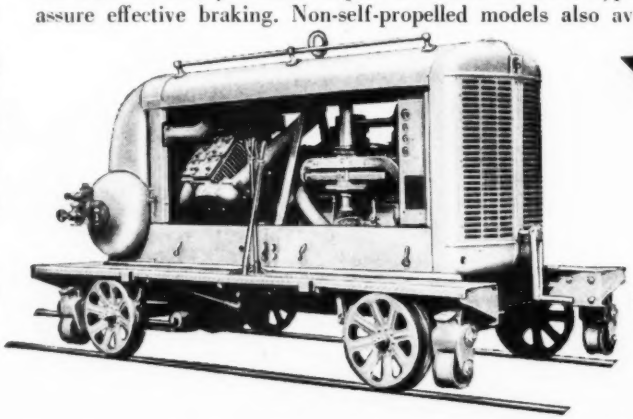
For nipping, small rises, and on jobs where the track is raised several inches, CP-3D Tie Tampers are unequaled.

AMPLE AIR FOR THE BIG TRACK JOBS

CP Flanged-Wheel Mounted Compressors are available in 105, 160, 210, 315 and 500 c.f.m. actual capacity, gasoline or Diesel driven.

Self-propelled models are powered by simple but sturdy air motor — no complicated, troublesome clutches or gears — one lever controls both forward and backward movement. Free wheeling device disengages drive for safe towing at high speeds.

Four hand-operated, "one-man" type, lifting jacks, with transverse wheels, make it easy to shift compressor from tracks. Shoe type brakes assure effective braking. Non-self-propelled models also available.



Keeping pace with the demands of modern railroading, Chicago Pneumatic offers a wide line of time-saving equipment to aid you in improving quality of work on maintenance-of-way jobs.

Write for full information on CP air compressors, also pneumatic and electric tools for railroad use.

SAVES HOURS OF NUT-RUNNING TIME

There's no quicker or easier way to run nuts, and to apply or remove bolts, studs and lag screws, than with a CP Reversible Impact Wrench. Its impacting force is entirely rotary, and is controlled by regulation of air pressure.

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Efficient magneto ignition, eliminating batteries. Standard two-cycle engine operates on gasoline-oil fuel mixture, providing automatic lubrication.

Write for Bulletin SP-1943 — Maintenance-of-Way Equipment

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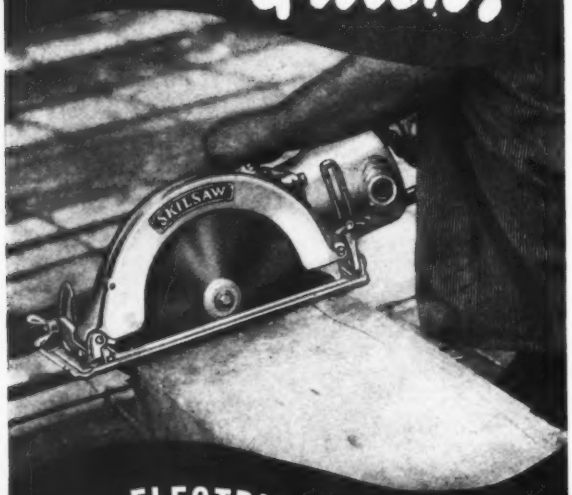

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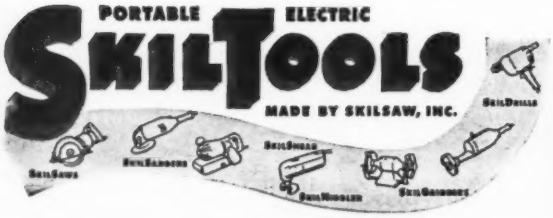

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3" to 24" I.D.

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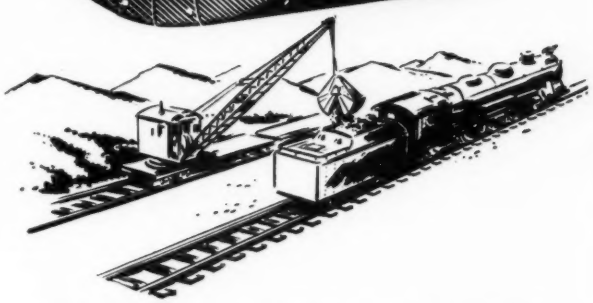

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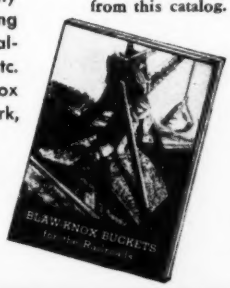

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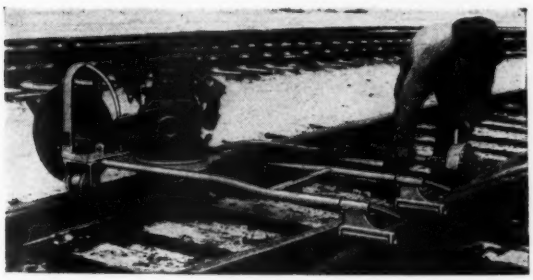

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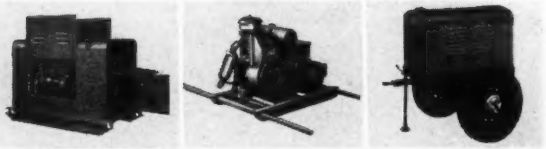

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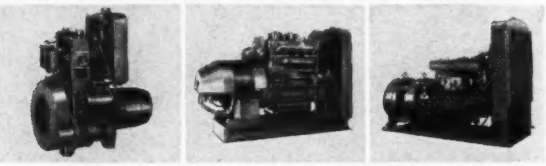
DEPENDABLE STAND-BY UNITS



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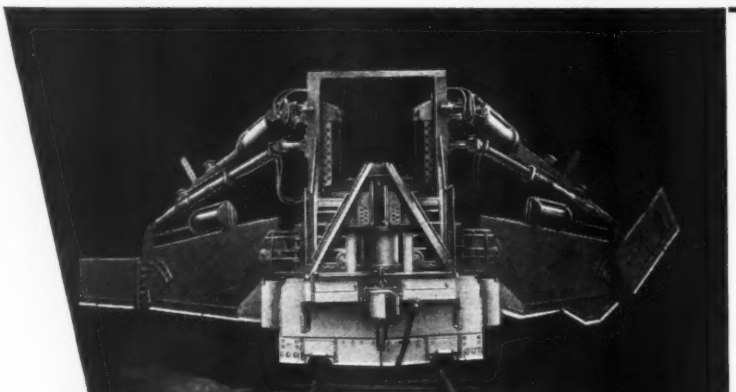

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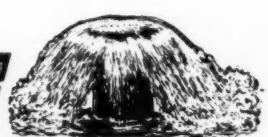

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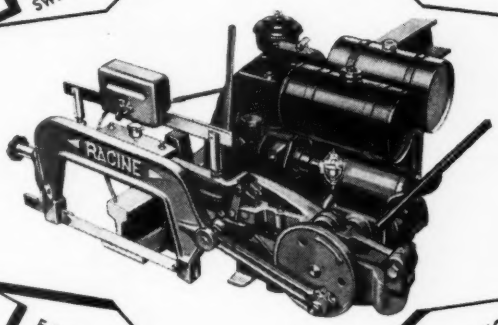

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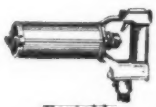

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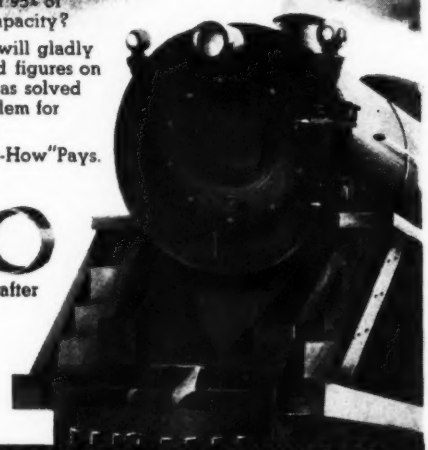

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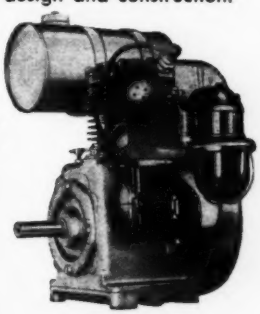
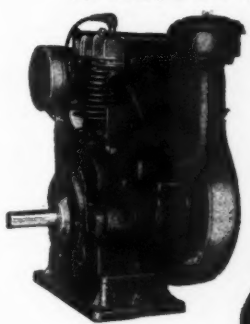
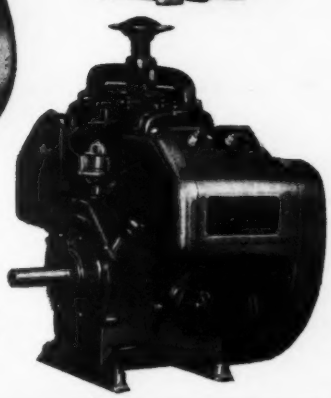


Typical 4-cycle single-cylinder model, 2 to 4 Hp.



Typical single cyl. model, 4 to 9 Hp.



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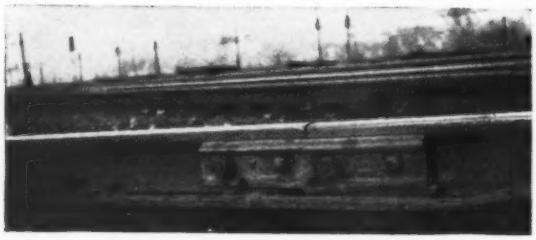

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Q and C Step Joints are available for all the new sections of rail. Allowance for wear on old rails can be made to provide a smooth riding surface.

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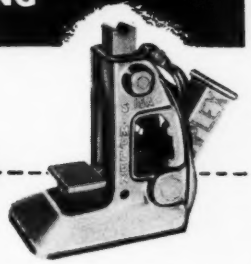
USE THE NEW Simplex 15A UNIVERSAL TRACK JACK



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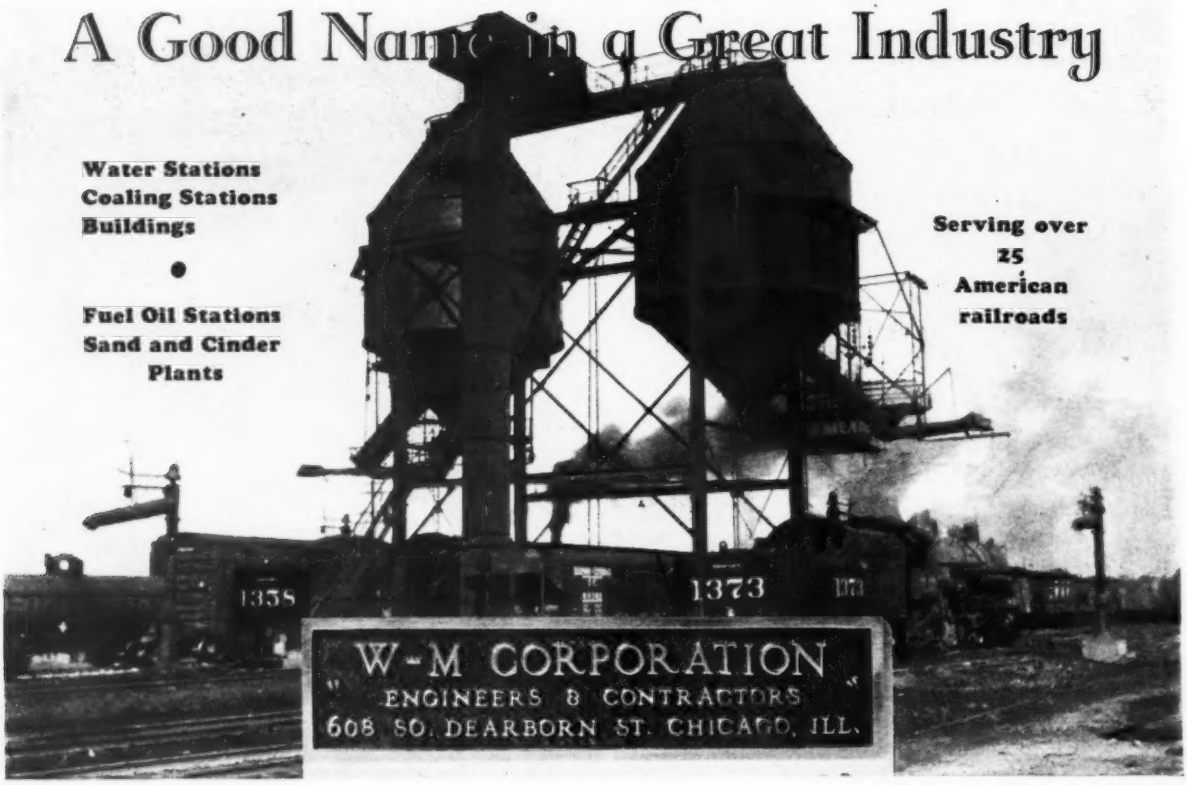

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ALPHABETICAL INDEX TO ADVERTISERS, JUNE, 1948

A

Air Reduction Sales Co. 556
Allis-Chalmers Tractor Division 564-565
American Brake Shoe Company 590
American Chain & Cable Co. 566
American Hoist and Derrick Company 574
Armco Drainage & Metal Products, Inc. 572

B

Barber-Greene Company 629
Barco Manufacturing Company 582
Beall Tool Division of Hubbard & Co. 629
Bethlehem Steel Company 553
Black & Decker Mfg. Co., The 575
Blaw-Knox Company 645
Briggs & Stratton Corporation 627

C

Chicago Pneumatic Tool Company 642-643
Cullen-Friestedt Co. 634

D

Dixie Cup Company 632

E

Eaton Manufacturing Company 552
Electric Tamper & Equipment Co. 558

F

Fabreeka Products Company, Incorporated 580
Fairbanks, Morse & Co. 557
Fairmont Railway Motors, Inc. 588
Flintkote Company, The 631

G

G & H Rail Controls, Inc. 571

H

Hubbard & Co. 629

I

Independent Pneumatic Tool Company 567
Industrial Brownhoist Corporation 559
Ingersoll-Rand Company 573

J

Jordan Company, O. F. 646

K

Kershaw Co., Inc., The 578
Koppers Company, Inc. 583-633

L

Layne & Bowler, Inc. 647
LeTourneau, Inc., R. G. 568-569
Lewis Bolt & Nut Co. 651
Link-Belt Speeder Corporation 560

M

Mack Welding Co. 650
Maintenance Equipment Company 551
Mall Tool Company 649
Mid-West Forging & Manufacturing Co. 651

N

National Lock Washer Company, The 653
National Water Main Cleaning Co. 648
Nordberg Mfg. Co. 584
Northwest Engineering Company 555

O

Ohio Electric Mfg. Co., The 630
Ottawa Mfg. Co. 650
Oxweld Railroad Service Company, The 585

P

Page Steel and Wire Division 566
Pittsburgh Pipe Cleaner Co. 644
Portland Cement Association 570

Q

Q & C Company, The 650

R

Racine Tool and Machine Co. 647
Rail Joint Company, Inc., The 640-641
Railroad Accessories Corporation 587
Rails Company, The 562
Railway Track-work Co. 645
Ramapo Ajax Division 590
Reade Manufacturing Company 625
Reynolds Metals Company 654
Ric-Wil Company, The 563
Rocket Distributors, Inc. 648
Rust-Oleum Corporation 628

S

Schramm, Inc. 621
Simmons-Boardman Publishing Corporation 650
Skilsaw, Inc. 644
Sperry Products, Inc. 561
Sperry Rail Service 561
Stonhard Company 638
Syntron Co. 648

T

Templeton, Kenly & Co. 651
Texas Company, The 554
Timken Roller Bearing Company, The 577

U

Union Carbide and Carbon Corporation 585
Union Metal Manufacturing Co., The 576
United States Motors Corp. 646

V

Viking Pump Company 651

W

W-M Corporation 652
Warner & Swasey Co., The 639
Weir Kilby Corporation 623
Williams & Co., J. H. 579
Willson Products, Incorporated 634
Wisconsin Motor Corporation 649
Woodings Forge & Tool Co. 619
Woolery Machine Company 637
Worthington Pump and Machinery Corporation 581

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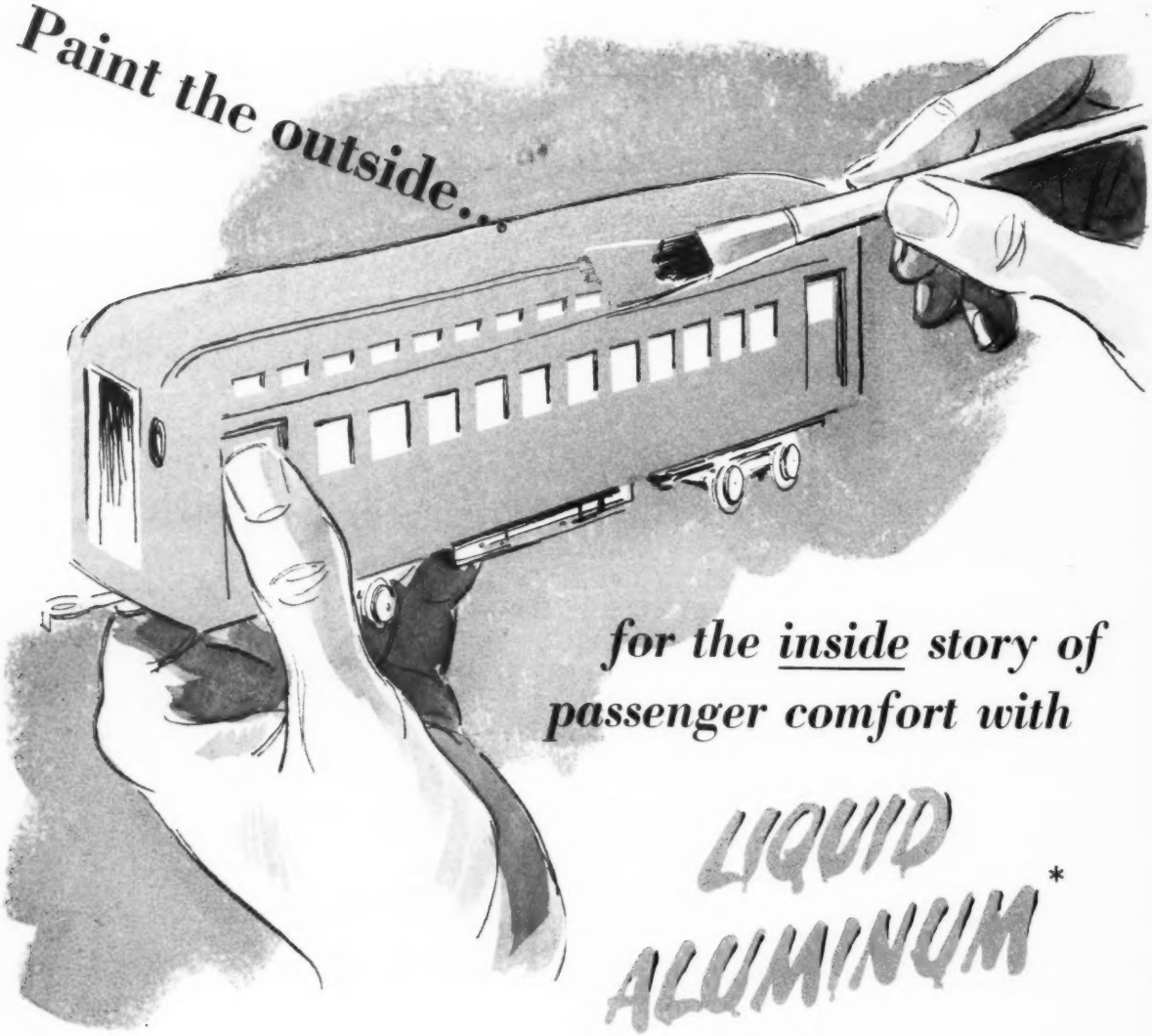

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